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RUSCHENBERGER'S SERIES.

FIRST BOOKS OF NATURAL HISTORY.

ELEMENTS OF HERPETOLOGY,

AND OF

ICHTHYOLOGY:

PREPARED FOR THE USE OF

SCHOOLS AND COLLEGES,

BY

W. S. W. RUSCHENBERGER, M.D.

Surgeon in the U. S. Navy; Fellow of the College of Physicians; Hon.
Member of the Philadelphia Medical Society; Member of the
Academy of Natural Sciences of Philadelphia, &c. &c.

4

FROM THE TEXT OF

MILNE EDWARDS, AND ACHILLE COMTÉ,

PROFESSORS OF NATURAL HISTORY IN THE COLLEGES
OF HENRI IV, AND CHARLEMAGNE.

WITH PLATES.

PHILADELPHIA:
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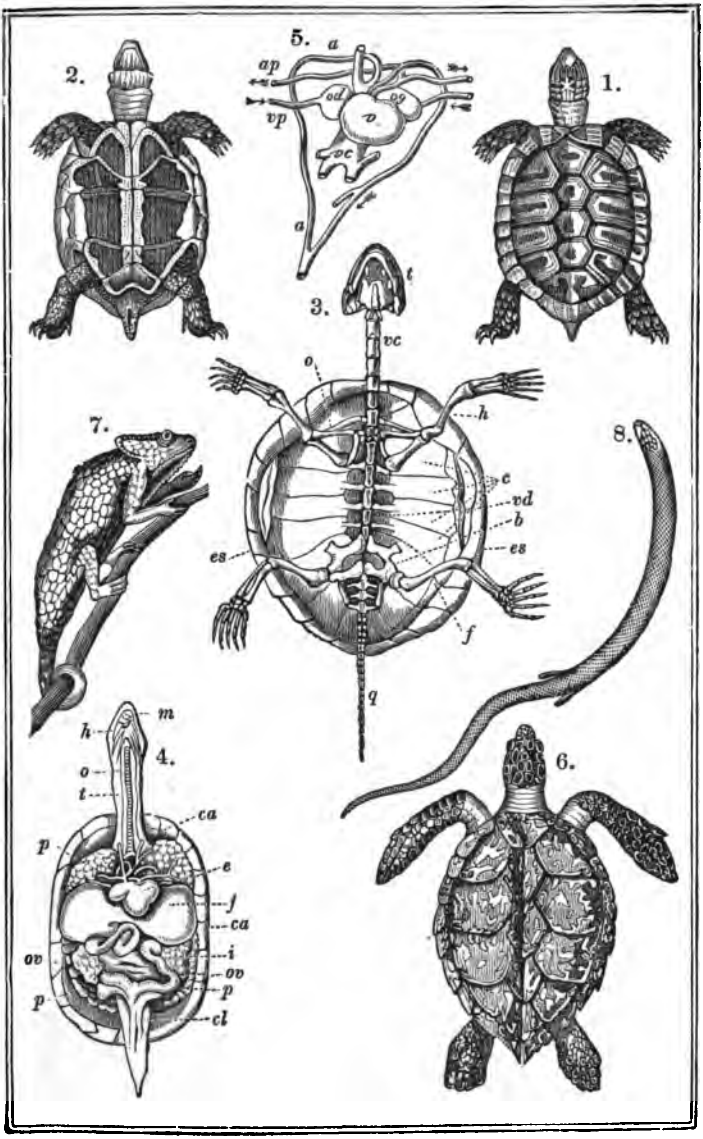

Reptiles.

RUSCHENBERGER'S SERIES.

FIRST BOOKS OF NATURAL HISTORY. [iv]

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FOURTH BOOK OF NATURAL HISTORY

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PREFACE.

The Fourth of the Series of First-Books of Natural History, treats of Reptiles and Fishes, two classes of the Animal Kingdom, which are vastly useful to man, affording him inexhaustible supplies of excellent food. Besides being useful, they are deeply interesting in a physiological point of view, illustrating as they do, in their economy, many of the important vital functions of our own organization. In them we see how the allwise, and benevolent Creator has wonderfully adapted their structure to the circumstances under which they were destined to breathe, and have their being; and at almost every step we might pause to admire the surpassing wisdom of Him who made them such, and bow down in gratitude for the bounties showered upon us, every where in this boundless and beautiful creation. But had we given place to reflections of this nature in the course of our little work, we should have far exceeded our limits, and probably obscured the sketch we wished to draw clear and intelligible.

Some objection may be made perhaps to the systematic names and technical words, which have been necessarily used without immediate explanation. To meet this difficulty, a copious glossary, with the etymologies and pronounciation of the words, has been added, which will facilitate the young reader, and prepare the way to more extensive reading on the subject. It will be seen that many of the words which have been explained in the glossaries of preceding books of the series, are also found in the present volume. This repetition renders each book, to a considerable extent, available by itself, and obviates the necessity of recurring from one to the other for the explanation of words. All persons who are desirous of acquiring a knowledge of Natural History, are not acquainted with the Latin and Greek languages; therefore, the words from the latter have been printed in *italics*, in preference to using the proper Greek characters, and the omega, where it occurs has been designated thus, *ô*.

As in the preceding volumes, I have not confined myself exclusively to the works of MM. Edwards and Comte, the chief sources from which the materials of these Primers have been derived; but I have freely availed myself also of the labours of Cuvier, T. Rymer Jones, and others.

It is not designed that the questions at the foot of the page shall be answered by repeating the text from memory; the pupil should be able to give the facts in his own language, and show he understands the subject.

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Philadelphia, July, 1842

HERPETOLOGY.

LESSON I.

GENERAL CHARACTERS.—*Form.—Skeleton.—Motion.—Nervous System.—Senses.—Nutrition.—Apparatus of Digestion.—Blood.—Respiration.—Lungs.—Temperature.—Secretion.—Eggs.—Classification.*

CLASS OF REPTILES.

1. That part of Natural History which treats of Reptiles, is termed Herpetology,—from the Greek, *erpeton*, a creeping thing, a reptile, and *logos*, a discourse.

2. The CLASS OF REPTILES comprises those *oviparous vertebrate animals that have cold blood, an aerial respiration, and an incomplete circulation.* They have lungs like mammals and birds; but their circulatory apparatus is always so arranged that a part of the venous blood mingles with the arterial, without having passed through the respiratory organ, and in general, this mixture takes place in the heart, which has a single ventricle, into which both auricles open.

3. In their general form, reptiles bear a closer resemblance to mammals than to birds; but in this respect they vary very much. The head is almost always small, and the body much elongated, (*Plate* 1, *fig.* 1, 6, *and* 7.); sometimes they are entirely without extremities, or only possess vestiges of them; but most of these animals have four paws, formed for walking or swimming. Ordinarily, their extremities are too short to prevent the body from dragging on the ground, and, instead of being parallel to the axis of the body and moving in this direction, they generally stand out from the side and move from without inwards, perpendicularly to the axis of the body, an arrangement very unfavourable to locomotion; most reptiles seem to creep rather than walk, from which circumstance they derive their name.

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1. What is Herpetology?

2. What are the general characters of those animals that are comprised in the Class of Reptiles?

3. What class of animals do Reptiles more closely resemble in their general form? What is the position of their extremities? From what circumstance do they derive their name?

4. The skeleton in reptiles is composed of almost the same bones as those we have already seen in mammals and birds; but it often happens that some among them are entirely wanting: serpents, for example, have no extremities, nor have they any sternum; and frogs have no ribs.

5. The head, in the arrangement of its bones, resembles that of birds more than that of mammals; the cranium is small; the face is generally much elongated, and the lower jaw is suspended from a tympanic bone, which is placed between it and the cranium. In general, the head is articulated with the vertebral column by a single tubercle (or condyle,) which has many facettes, and possesses only very slight mobility.

6. The structure of the vertebral column differs extremely in the different reptiles: in serpents it is very long and very flexible; in frogs it is very short and slightly moveable; and in tortoises its middle part is united so as to form a single bony piece.

7. Generally, the ribs are very numerous; in serpents, they exist through almost the entire length of the body; the same is the case in certain reptiles resembling lizards, while in others, these bones are merely rudimentary, or entirely wanting. In tortoises, they are soldered, as it were, to each other; and with the dorsal portion of the vertebral column, form the great shield or buckler which covers the backs of these animals, and which is called *carapax.*

8. Without being as much developed, the bones of the shoulder are very analogous to those of birds. The anterior extremity consists of an arm composed of a single bone, the humerus; a fore-arm consisting of a radius and ulna, generally distinct from each other, and a hand which is sometimes in the form of a fin, and sometimes resembling a foot.

9. The movements of reptiles, are, in general, less active, and less sustained than those of animals with warm blood, as might be anticipated from the more limited character of their respiration; for there always exists an intimate relation between these two functions. Their muscles receive less blood, and are of a whitish tint; and it is also remarked that these organs preserve their irritability for a longer time after they have been removed from the influence of the nervous system. In warm-blooded animals, the

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4. What is the character of the skeleton in Reptiles?
5. What is the general character of the head in Reptiles?
6. Is the structure of the vertebral column the same in all Reptiles?
7. What is the character of the ribs in Reptiles?
8. What is the character of the anterior extremity of Reptiles?
9. Why are the motions of Reptiles less active than those of mammals and birds? What are the characters of the muscles of Reptiles?

destruction of the brain and spinal marrow, or the section of a nerve is at once followed by a complete paralysis, either general or local, and, very soon after this phenomenon occurs, it becomes impossible to excite muscular contraction, by pricking or otherwise stimulating the affected parts. In reptiles, on the contrary, the faculty of moving under the influence of stimulation, is preserved under similar circumstances, for a very long time; for example, the tail of a lizard detached from the body, continues to move for several hours, and we may often see a tortoise that has been apparently dead for several days, move its limbs when the muscles are stimulated by pricking them. We may conclude that, in these animals, the division of the physiological labour and localization of the different functions of the nervous system, are not carried so far as in mammals and birds, and hence there is a less intimate dependence of the different parts of the economy upon each other.

10. The encephalon of reptiles is but little developed; the surface of the brain is smooth and without convolutions. The two hemispheres are oval, more or less elongated, and internally hollowed by a single ventricle. The spinal marrow, compared with the brain, is very much developed, and it is also remarked that the nerves are larger, proportionally to the volume of the central parts of the nervous system, than in the superior animals.

11. Most reptiles have no special organ of touch, and the nature of their integuments prevents their tactile sensibility from being much developed. It is true, that in some of them the skin is entirely naked, and the epidermis is scarcely distinct; but, for the most part, it is covered by a thick epidermic layer, composed of horny or bony plates which are more or less hard. In reptiles with a naked skin, and an epidermis of moderate consistence, it is frequently detached and renewed; and, in those animals where it is most consistent, it becomes detached, at different seasons of the year, to give place to a new epidermis; sometimes this kind of moulting is partial, or at least, the epidermis only falls off in flakes; but at other times it is entirely detached, and preserves the form of the animal upon which it grew. Serpents shed their coats in this way several times in the course of the year.

12. The eyes are ordinarily small, but in their structure, are like those of mammals and birds; but there is rarely found in them any prolongation or fold of the retina resembling the *pecten*.

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10. What is the general character of the Encephalon? What is remarkable in the nerves of Reptiles?

11. Have Reptiles an organ of touch? Is the epidermis permanent in Reptiles?

12. What is the general character of the eyes of Reptiles? Have they any eye lids?

The orbits are incomplete, and generally there is a third eye-lid which is semi-transparent, and moves transversely.

13. The structure of the ear is less complicated than in the superior animals. The external ear is almost always entirely wanting; there is no auditory canal, and the tympanum is on a level with the head and exposed, or concealed beneath the skin. The organ of smell is but little developed; the nasal fossæ are generally very small, and the pituitary membrane—the lining membrane of the nose—presents few, or no folds.

14. Most reptiles swallow their food without chewing it, and their sense of taste appears to be very dull. The tongue is sometimes thick and fleshy; but, in general, it is thin, dry, very protractile, and often bifid; it sometimes becomes an organ of prehension, the play of which is very remarkable.

15. Few reptiles live exclusively upon vegetable matter. Almost all of them are carnivorous, and, with some exceptions, they hunt living prey which they generally swallow whole: the selection of the animals upon which they feed, is, in a measure, regulated by the dimensions of their mouth. Most of them drink but little, and they can fast for a very long time without inconvenience.

16. The mouth is deeply cleft, and generally armed with teeth, which are sometimes found in the palate as well as in the jaws; they are almost always of a conical form, and, in general, in place of being lodged in alveoli, they are soldered, as it were, by their base to the bone that sustains them. In some reptiles that are without teeth, the jaws are covered by a horny plate, the edges of which are trenchant, like the beak of a bird; but they never have fleshy and moveable lips like mammals.

17. Glandular organs in considerable numbers ordinarily surround the mouth of reptiles, and pour into it either a gluey humor or saliva; sometimes there are also glands, very closely resembling salivary glands, which secrete a violent poison.

18. As it is not necessary for their food to remain in the mouth for mastication, a veil of the palate would have been, in general, useless, and, in fact it rarely exists. In most of these animals, the pharynx is not distinct from the mouth, and often

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13. Is the organ of hearing the same in Reptiles as it is in mammals? Is the sense of smell acute or otherwise?

14. Have Reptiles a strong sense of taste? What is the character of the tongue?

15. Upon what do Reptiles generally feed? Do they drink much?

16. What is the form of the teeth of Reptiles? Where are they situate? Do they exist in all Reptiles?

17. What is the character of the glands found about the mouth?

18. Have Reptiles any veil of the palate? What is the character of the pharynx? What are the general characters of the digestive organs?

there is not a well defined line of demarcation between the œsophagus and stomach, which is simple and various in form. The intestines are short and without a cœcal appendix; the large intestine differs little from the small, and terminates in a cloaca. The liver is generally voluminous, and there is a gall bladder, pancreas, and spleen.

19. The blood of these animals is red, and its globules are elliptical. Their volume is much greater than in mammals and birds, and the number of them is considerably less. The disposition of the circulatory apparatus varies; but there is always a direct communication between the vascular system of red (arterial) blood, and the vascular system of black (venous) blood, so that these two liquids mingle with each other, and the organs receive only blood, imperfectly arterialised by the act of respiraton. The heart is almost always composed of two auricles, (*od*, *og*,) which empty into a single ventricle, (*v*.) Therefore, the arterial blood coming from the lungs and received in the left auricle, (*og*.), and the venous blood coming from different parts of the body into the right auricle, mingle in a common ventricle, (*v*.) One part of this mixture returns by the aorta to the different organs it is destined to nourish, and another goes to the lungs, through the pulmonary arteries (*ap*,) which rise immediately from the common ventricle or from the aorta itself.* It appears that in crocodiles, the heart is the same in form as it is in birds and mammals, and a partition separates the right ventricle from the left: therefore the arterial does not mingle with the venous blood; but there is a particular arrangement of the arteries which effects this mixture at a short distance from the heart, and the vessels

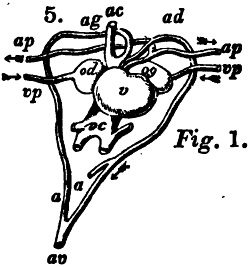

Fig. 1.

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* *Explanation of the Figure.*—Heart and principal vessels of a tortoise,—*v*, ventricle,—*od*, right auricle, which receives the blood from the great venous trunk, (*vc*,) and pours it into the ventricle, (*v*);—*og*, left auricle, which receives the arterial blood coming from the lungs by the pulmonary veins, (*vp*) and also pours it into the ventricle;—*ag*, *ad*, the two aortas which arise from the single ventricle, and which, after being carried backwards, unite to form the vertical aorta, (*av*);—*ac*, branch of the right aorta which furnishes the carotid, brachial arteries, &c.—*ap*, *ap*, the two pulmonary arteries, the common trunk of which arises from the ventricle along side of the aortas. The arrows indicate the course of the blood.

19. What is the colour of the blood in Reptiles? How does their circulation differ from that of mammals? What is the course of the circulation in Reptiles?

of all the posterior half of the body only receive imperfectly arterialised blood. Until lately, it was believed that, in other animals of this class, (the Batrachians,) there was, on the contrary, but a single ventricle, but it has been demonstrated to be otherwise.

20. Respiration is carried on with little activity in reptiles; most of these animals consume but little oxygen, and can be deprived of it for a long time without becoming asphyxiate. Temperature exerts the greatest influence over this function, and in the warm season, the necessity of breathing is more vividly felt than in winter. A frog, for example, deprived of air in the summer, perishes in less than two hours; while in winter, it will continue to live for several days. In some reptiles, there are branchiæ (gills,) during the early period of life; but the lungs are soon developed, and then the branchiæ disappear, so that the same animal has at first an aquatic, and afterwards an aërial respiration: there are some even that preserve these organs throughout life, and which, having lungs at the same time, are completely amphibious; but most reptiles have lungs only. We must not conclude however, that their respiration is exclusively aerial; for, in many of these animals, the skin is also a respiratory organ, and can act on the air dissolved in the water as well as upon the oxygen of the atmosphere. In some reptiles, this cutaneous respiration is even so active as to be, under certain circumstances, sufficient for the maintenance of life.

21, The organization of the lungs is not favourable to great activity of respiration; their air cells are very large, and consequently the vascular surface designed for contact with the air, is but of little extent. They are not lodged in a peculiar cavity, the thorax not being separated from the abdomen by a diaphragm, and the air is renewed in them with less facility and less regularity than in the superior animals.

22. Reptiles are all cold blooded animals, that is, they do not produce sufficient heat to maintain a temperature above that of the atmosphere. Their whole body is warmed or cooled at the same time with the surrounding medium, and the changes of temperature which they experience powerfully influences all their functions. A temperature of about one hundred, to one hundred and twenty degrees of Farenheit's thermometer, is promptly fatal

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20. What is the character of respiration in reptiles? How is it influenced by different temperatures? Is it always carried on by the means of lungs.

21. How do the lungs differ in organization and situation from the same organs in mammals?

22. Why are reptiles called cold blooded animals? What are the effects of temperature on the vital phenomena of reptiles?

to most of these animals, and cold tends to abase all vital phenomena in them. In winter most of them cannot digest substances taken in the stomach, and they do not take food. Their respiration is also lowered in the most remarkable manner. A frog, for example, which, in summer, dies from asphyxia in less than two hours by the complete deprivation of atmospheric air, or even by strangulation, can, in the cold season, resist asphyxia for several days, and live for many months without taking air into the lungs, but solely by the assistance of cutaneous respiration. Reduction of temperature often induces in reptiles, a lethargic state, analogous to that of hibernating animals.

23. Except the production of poison in certain serpents, the secretions of this class of animals are not particularly remarkable.

24. Having no means of suckling their young, reptiles are reproduced like birds, by the means of eggs. In some instances, the eggs are hatched before they are laid, and the animals in which this phenomenon takes place, are said to be *ovoviviparous*.

25. This Class is composed of four great natural divisions, namely: 1st. The Tortoises; 2d. the Lizards, and other reptiles resembling them in organization; 3d. the Serpents; and 4th. the Frogs and other reptiles of analogous structure. These four Orders are designated under the names of Chelonia, Sauria, Ophidia, and Batrachia. The principal characters which distinguish them may be seen in the following table:

				(Orders.)
CLASS OF REPTILES.	No metamorphosis. Respiration always aerial. Branchiæ never. Body covered by scales, rings, or a carapax.	Having extremities; moveable eyelids.	Covered by a *carapax*. (Jaws without teeth, and furnished with a horny envelope.)	CHELONIA.
			Without carapax. (Jaws armed with teeth, and without a horny envelope.)	SAURIA.
		Without extremities; generally without moveable eyelids; teeth.		OPHIDIA.
	More or less transformation in early life; respiration at first aquatic, and effected by the aid of branchiæ, then aerial and pulmonary. Skin naked, without carapax or scales; no nails; almost always having extremities.			BATRACHIA.

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23. Are the secretions of Reptiles remarkable in any particular?

24. By what means are Reptiles re-produced?

25. Into how many orders is the class of Reptiles divided? How are these orders designated?

LESSON II.

ORDER OF CHELONIANS, or TORTOISES.—*Organization.—Division into four Families.—Land Tortoises.—Fresh water Tortoises.—River Tortoises.—Sea Tortoises.—Tortoise Shell: its use.*

ORDER OF CHELONIA.

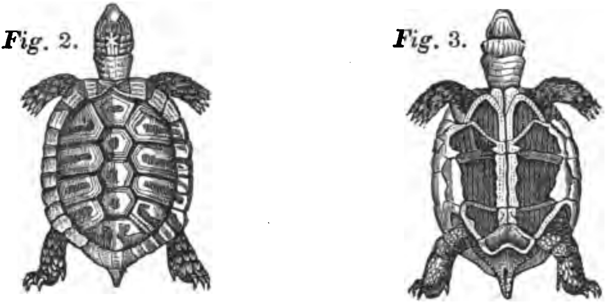

Fig. 2. *Fig.* 3.

GREEK TORTOISE.

1. Tortoises are recognised at first sight by the curious defensive armour with which nature has provided them. A double shield envelopes all parts of their body, except the head and neck, the four paws and tail, which in general, may be also concealed in this species of solid box.

2. When studying the mammalia, we mentioned some animals that have the body protected by a sort of shell. The Armadillo furnished an example; but that armour, formed only of agglutinated hair, or by a particular modification of the epidermic layers of the skin, in no wise resembles the double shield of the Tortoises; for the latter is composed of bones, which are widened, and intimately united to each other; the *carapax*, (2.) or upper shell is formed by the union of the ribs and dorsal vertebræ; the *plastrum*, (3.) or lower shell, is the sternum. Consequently, these organs are a portion of the skeleton which, instead of being lodged in the substance of the soft parts, has become superficial, and is only covered by a thin, dry skin.

3. The bony frame of tortoises, to present this unusual disposition, must be, of course, extremely modified: still, we find in

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1. What is the most striking feature of Tortoises?
2. What is the essential constitution of the upper, and of the lower shell of Tortoises?
3. How does the skeleton of a Tortoise differ from that of a mammal?

it, the same pieces which compose the skeleton of the higher vertebrate animals; except that many of these pieces are changed in form and size.

4. When we examine the *carapax* of a Tortoise, (*Fig.* 4,) we see that it is formed of a considerable number of bony plates, united to each other by sutures, and that eight of these plates occupy the middle line, on each side of which, sixteen form a longitudinal row, and twenty-five or twenty-six surround the whole, like an oval frame. It is then difficult to recognise the nature of these bones; but, if we examine the carapax on its inferior surface, we at once see (*Plate* 1, *fig.* 3.) that the middle pieces are simply dependencies of the dorsal vertebræ, (*vd.*) In fact, we find beneath it, the body of each one of these bones of its ordinary form, as well as the vertebral canal for the lodgement of the spinal marrow; but the superior portion of the parietes of the ring, which constitutes this canal, instead of having, as is usual, the form of a transverse bony band, separated by a space from its fellows, and being surmounted by a spinous process, is here widened like a disk, and without any interruption is continuous with the analogous plates belonging to the vertebra which precedes, and that which follows it. Each of these dorsal vertebræ, in this way rendered immoveable, sustain a pair of ribs as in man, and other vertebrata; but these ribs are widened so as to touch each other throughout, or nearly throughout their whole length, and join each other by sutures (*c.*); the marginal pieces, which articulate with the extremity of the ribs, and in a degree surround the carapax, evidently represent the sternal portion of these bones, which, in mammals, remain always in a cartilaginous state; but in birds, they are completely ossified. They also remain cartilaginous in some Tortoises, and many of them laterally support themselves by the edges of the sternal *plastrum*.

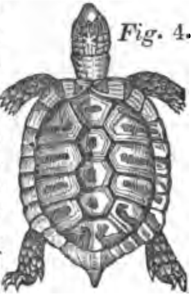

Fig. 4.

5. The sternum of Tortoises presents an extraordinary developement; it extends from the base of the neck to the origin of the tail, and covers the whole inferior surface of the body, (*Fig.* 5.) The pieces which enter into its composition, are nine in number, and, instead of being placed in a row as in mammals, with a single exception, they are arranged in pairs, and soldered or articulated with each other,

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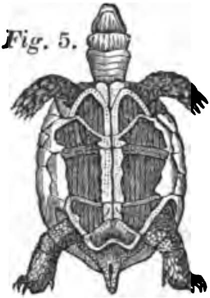
4. What is the Carapax? How is it formed?
5. What is the Plastrum? How is it constituted?

Fig. 5.



so as to form a great oval plate. Sometimes this shield is entire, and solid throughout its whole extent, sometimes it is divided into three portions, the anterior and posterior of which are slightly moveable, and other times it is hollowed in the centre like a frame; and, it is fixed on each side to the carapax, either by a broad bony prolongation, or by cartilages, and it is through a sort of slit, or opening left betwixt these two shields or shells, in front and behind this articulation, that the head, extremities, and tail, are protruded.

6. The carapax and plastrum are only covered by the ordinary skin of this animal which is ordinarily scaly. No muscle is inserted into their surface, and consequently the muscles of the neck and extremities are attached to the interior of the trunk. The shoulder, instead of being sustained by the external parietes of the thorax, is lodged in the interior of this cavity; and the pelvis, so to speak, is contained in the cavity of the abdomen; and the marginal pieces of the carapax are advanced beyond the base of the neck and tail, so that these parts seem to project from the same cavities.

7. The cervical vertebræ, *(vc.)* far from being immoveable as they are in the back, are so articulated with each other as to permit, in general, of extended movements, similar to those of the neck of a bird. Their number is ordinarily eight, and their articular surfaces are alternately convex and concave, instead of being plain as in mammals. In some tortoises the neck is not retractile; in others, it can be completely folded beneath the carapax, either by bending downwards on itself, or to one side.

8. The head of Tortoises is small compared with the body, and the cranium is small compared with the head. Generally, it is flattened, and widened posteriorly by large temporal fossæ, which are ordinarily concealed beneath a bony arch. The upper jaw is solidly fixed to the cranium, and is entirely immoveable. The square, or tympanic bone, which supports the lower jaw, is articulated in the same manner to the adjoining bones, and forms the larger part of the vicinity of the frame of the tympanum; the lower jaw is composed of a great number of bony pieces: there are six on each side.

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6. Are there any muscular attachments on the external surfaces of the carapax and plastrum? Is the shoulder on the inside or outside of the chest?

7. Do the cervical vertebræ move freely on each other or not? What is their usual number?

8. Is the upper jaw of Tortoises moveable? How is the lower jaw articulated with the skull? Does the lower jaw consist of a single bone or more?

9. The bones of the shoulder (*o.*) articulate on one side with the vertebral column, and with the sternum on the other, so as to form a sort of ring betwixt the carapax and plastrum, through which pass the œsophagus and trachea.* We here observe three branches, which often unite solidly with each other at an early age, and which converge and form by their union, the articular cavity of the humerus. One of these bones, (*o.*) suspended to the vertebral column, is evidently the scapula; the second, which is directed backwards, is analogous to the coracoid bone of birds, and the third, which descends to join the plastrum, is the representative of the clavicle, or at least, the acromion process of the scapula, with which this bone ordinarily articulates.

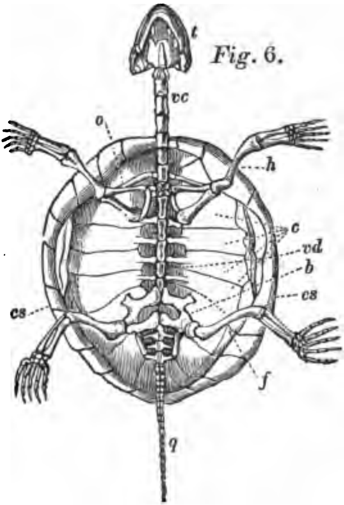

Fig. 6.

10. The pelvis (*b.*) resembles the ring formed by the bones of the shoulder.

11. The extremities are not very remarkable in the disposition of their bony frame. They are always short; sometimes they are truncated at the end, and at others flattened and elongated into a paddle; and in all, the fingers are only slightly moveable, and in general, they are not very distinct externally.

12. The skin that covers the body of these animals sometimes preserves its softness, and is not covered by scales; but in almost all of them, it is furnished with a horny layer, of very great consistence. These scales form large plates on the carapax and plastrum, the arrangement and aspect of which vary according to the species; those which cover the carapax of a species of

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**Explanation of the Figure.*—Skeleton of a Tortoise. (The sternal plastrum removed to show the interior of the thorax):—*t*, the head,—*vc*, cervical vertebræ,—*vd*, dorsal vertebræ,—*c*, the ribs, anchylosed with the dorsal vertebræ to form the carapax,—*cs*, sternal portion of the ribs, or marginal pieces of the carapax,—*o*, scapula,—*cl*, clavicle,—*co*, coracoid bone,—*b*, pelvis,—*f*, femur,—*ti*, tibia,—*p*, fibula.—*q*, caudal vertebræ.

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9. What is the peculiarity of the connexion of the bones of the shoulder with the vertebral column?

10. What is the arrangement of the bones of the pelvis?

11. What is the general character of the extremities?

12. What is Tortoise shell?

Sea Tortoise, are remarkably beautiful, and are employed in the arts under the name of *Tortoise shell.*

13. The eyes of Tortoises are protected by three lids like those of birds. The tympanum is large, but ordinarily concealed beneath the skin, and the nostrils are pierced through the extremity of the muzzle.

14. As we have already stated, these animals are unprovided with teeth, and their jaws are furnished with a horny envelope, with cutting edges, like those of birds. Some live on marine plants, and others on small animals as well as vegetables. They require little nourishment, and they have been known to pass months, and even years without eating.

15. The elevator muscles of the jaw are very powerful, and when a Tortoise has seized hold of any thing in the mouth, it is almost impossible to get it away. The tongue is more complicated in its structure than that of most Reptiles: it is thick, and studded with filiform papillæ. The stomach does not seem to differ from the neighbouring parts of the digestive tube, except that it is rather larger; the intestine is of moderate length, and has no cœcum; the liver is voluminous.

16. The lungs are very large, and lodged in the same cavity with the other viscera,* (*Fig.* 7.) The mechanism by which the air enters them is entirely different from that of other animals in which the thorax is dilatable. The parietes of this cavity being immoveable in most Tortoises, the air is forced into these organs by the action of the mouth. The jaws being closed, the animal lowers the hyoid bone, which enlarges the cavity of the mouth, and the air having entered through the nostrils, the posterior nares are closed, and then raising the hyoid bone, as if to swallow, the air thus inclosed, is forced to descend through the trachea. Therefore, the animal breathes by a sort of deglutition.

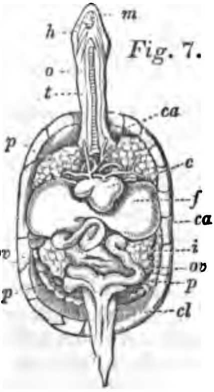

Fig. 7.

**Explanation of the Figure.*—Viscera of a Tortoise—*m*, the jaws,—*h*, the hyoid bone,—*o*, the œsophagus,—*t*, the trachea,—*p*, *p*, the lungs,—*c*, the heart and principal vessels,—*f*, the liver,—*i*, the intestines,—*cl*, the cloaca,—*ov*, the ovaries,—*ca*, *ca*, the carapax.

13. Have Tortoises any eye-lids? What is the character of the ear? Where are the nostrils situate?

14. Upon what do Tortoises feed?

15. What is peculiar in the tongue of Tortoises? What is the character of the stomach and intestines?

16. How do Tortoises breathe?

17. Tortoises lay eggs with a hard shell, which they deposit in the sand or earth, in some situation exposed to the sun, to cause them to be hatched. The males are generally smaller than the females, and are ordinarily recognised by the plastrum which is slightly concave. The duration of life in these animals is very great: authentic instances are known of land Tortoises that have lived a hundred and twenty years, even two hundred years, and some cases of a still greater age are related.

18. The habits of these animals vary, and these differences, which coincide with the modifications of their structure, has caused them to be divided into four principal families. Their chief characters may be seen in the following table:

Tortoises, having the feet		(Families.)
large, truncate at the end, and formed for walking only, and having the toes united in a common mass as far as the nails.		Land Tortoises.
flattened, and provided with distinct toes, simply united by a palmate membrane	incomplete. Carapax furnished with scales.	Pond Tortoises.
	complete. Carapax covered by a soft skin.	River Tortoises.
flattened, in the form of large swimming paddles, and not having the toes externally distinct.		Sea Tortoises.

19. The Land Tortoises,—*Testudo*,—(*Plate* 1, *fig*. 1, *and* 2.) have feet formed for walking only; their legs are, as it were, truncate, and their toes are short, and united to the nails; their number is five in front, and four behind. The carapax is very much vaulted, and they can draw the head, tail, and extremities, completely within their shell. They live in the woods, or in places well furnished with herbage: they never go into the water, but often inhabit its neighborhood. Most of them feed chiefly on vegetables, and terrestrial mollusks. They make a kind of burrow, and in temperate climates pass the winter in a state of hibernation. Their eggs are generally spherical and furnished with a hard shell; the female deposites her eggs in a hole, and seems to take no care of her young. The most common European species is the Greek Tortoise,—*Testudo græca*,—which is

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17. By what agency are the eggs of Tortoises hatched? How does the male differ from the female? What is the duration of life in Tortoises?

18. How is the order of Tortoises divided?

19. How is the family of Land Tortoises characterised? What are the habits of Land Tortoises? Where is the Greek Tortoise found?

yellow, spotted with black, and about six inches long; it inhabits Greece, Italy, France, and the large Islands of the Mediterranean. In Italy, and Sicily, this species is eaten.

20. THE FAMILY OF POND TORTOISES, (or Fresh Water Tortoises,—*Emys.)*—much more numerous than the preceding, forms a sort of connecting link between the Land Tortoises, and those that are essentially aquatic; it is composed of Chelonians that commonly live in marshes, and can swim, but yet differ very little from the preceding in their organization. They are chiefly distinguished by the conformation of their paws. The toes, five in number, are distinct, moveable, furnished with hooked nails, and united at their base by a palmate membrane of greater or less extent; but these characters are not always clearly marked.

21. As in the Land Tortoises, the carapax is, in general, entirely solid and oval in form; but instead of being elevated, it is more or less depressed. The neck is almost always longer than in the preceding, and presents remarkable variations in its conformation. In some, it is cylindrical, and surrounded by a loose skin which permits it to be entirely drawn within, and at the middle part of the carapax, while in others, it is a little flattened, and covered by a close cutaneous sheath, which adheres to the muscles, so that it can only be folded laterally on the body. Almost all of them can conceal their paws between their shells, and like the preceding, they have but four nails on the hind feet. Their motions are not as slow as those of the Land Tortoises, and they swim with considerable facility. Their chief food consists of fluviatile mollusks, batrachians, and annelides: they are found on the margins of lakes, marshes, and rivulets, in which the current is not rapid.

22. The genus of Cistudes belongs to the division of fresh water Tortoises, with a retractile neck: it is distinguished by the sternum which is furnished with twelve plates, and divided into two nearly equal parts, both moveable, and by the short tail. The European Cistude, or Mud Tortoise,—*Testudo europæo,*—has a depressed carapax, tolerably smooth, blackish with yellow points, and about six inches long. It inhabits stagnant waters, at the bottom of which it loves to keep buried in the mud. On the approach of the cold season, it retires into holes, to hibernate. It is found in the south of France; but it is particularly common

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20. What are Pond Tortoises? How are they distinguished from Land Tortoises?

21. What are the characters of the Pond Tortoises? Where are they found?

22. What are the characters of the European Cistude?

in Greece and Italy. Its flesh is used as food, and it is reared for that purpose, with bread, young vegetables, &c.

23. Some fresh water Tortoises have the sternal plastrum divided into two flaps, which they can at will, by a moveable articulation, close against the carapax, when their head and extremities are drawn in, so as to inclose themselves in a box; this peculiarity has obtained for them the name of ***Box-tortoises.***

24. There are some fresh water Tortoises, on the contrary, that cannot enclose themselves within the shell. Amongst these is the Snapper,—*Testudo serpentina*,—which is readily distinguished by its long tail, which is studded with sharp crests. It is found in the warm parts of the United States.

25. The Family of River Tortoises, (or Soft-Shelled Tortoises,)—*Trionyx*,—differ from all the preceding in the conformation of their paws, which are designed for swimming, but are entirely unsuited for walking. The paws are very much depressed, and the toes, although very distinct, and more or less moveable, are joined as far as the nails by broad flexible membranes. The carapax is very much spread out, and almost flat, unprovided with scales, covered only by a skin which is soft, and entirely cartilaginous throughout its border, which structure has obtained for them the name of *Soft-shelled Tortoises;* the neck is generally elongated and protractile; the nostrils are prolonged into a sort of little trunk; the jaws are trenchant, and furnished with a fold of skin, which resembles lips; the limbs are short, and supplied with only three toes. To these external characters are added other anatomical peculiarities; for example, the carapax has no marginal pieces, and the sternal plastrum is not ossified in the middle.

26. These animals are essentially aquatic, and inhabit the rivers and lakes of the warmest regions of the globe: they swim with great ease, and remain on land only at night; they are very voracious, and feed chiefly on reptiles and fishes.

27. The Nile supports one species of these Tortoises, which is useful to Egypt by devouring a great number of young crocodiles the moment they are hatched; it is the Tyrse,—*Trionyx ægyptiacus*,—of Zoologists. Another species, which inhabits the rivers of South America, is remarkable for its ferocity, and for the delicacy of its flesh.

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23. What are Box-Tortoises?
24. What is the Snapper?
25. What are the characters of the Soft-Shelled Tortoises?
26. What are their habits?
27. What is the Tyrse?

28. The **Family of Sea Tortoises**,—(Turtle)—*Chelonia.*—The Tortoises that live in the sea, differ from all others, both in their conformation and habits. Their flattened paws, which are really paddles, are only suited for swimming, and their toes, which are closely pressed together, and enveloped in the same membrane, are entirely immoveable. Only the two first toes of each foot have nails, and these fall off at a certain time; and the anterior extremities, in place of being of nearly the same length as the posterior, are more than twice as long. The carapax is arched and cordiform; and near the edge of this shell, the ribs are not widened and soldered together, and, as in the preceding family, the sternum is in the form of a frame open in the centre. The nostrils are not prolonged into a trunk, but are surmounted by a fleshy mass, which acts like a valve, in closing these openings when the animal puts its head under water. The edges of the beak are very trenchant, and the upper mandible is hooked.

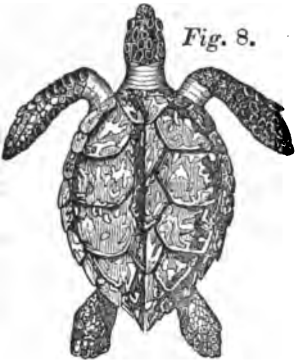
Fig. 8.

29. These tortoises feed principally on marine plants, and only leave the water in the laying season: they swim with great facility, and they are sometimes met several hundred leagues from land, floating on the surface of the sea: they appear to be able to sleep in this way, and they also dive very well. At the laying season, they leave their habitual haunts and resort to the shores of some desert island, to deposit their eggs in holes which they dig upon the beach. During the night the females leave the water for the purpose of laying; they drag themselves on the beach beyond the line of high tide, and with their anterior extremities excavate a hole about two feet deep in which they deposit their eggs in regular ranges, and cover them with sand, which they level off so carefully as to leave scarcely a trace of their labour. The operation over, they return immediately to the sea. The number of eggs is very considerable; sometimes as many as two hundred, and the laying is repeated two or three times a year. After exposure to the sun for fifteen or twenty days, they burst, and the young, which are not yet provided with shell, immediately make for the sea. Generally, they find difficulty at first

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28. What are the characters of Sea Tortoises?
29 What are their habits?

in plunging into it, and, before reaching it, they often become the prey of carnivorous birds, which seem to await the moment of their birth to feast upon them. They have also to dread voracious fishes and crocodiles, which assemble in the same places for the same purposes; the most part of those which escape their numerous enemies, acquire very considerable dimensions: they have been known to measure fifteen feet in circumference, and to weigh from five to six hundred pounds.

30. Marine tortoises are found in all warm seas; they abound about the West Indies, and particularly about a small archipelago near the main, known under the name of *Tortugas.*

31. Among these Tortoises, we distinguish the CHELONIA, in which the carapax is covered with horny plates or scales, and the SPHARGIS, which have only a coriaceous skin. The most common species of the first of these genera, are the *Green Tortoise,* (Turtle); the *Caret,* or *Hawks-bill Turtle;* and the *Caouane.* Only one species of Sphargis is known, the *Luth.*

32. The *Green Tortoise,—Testudo viridis,*—is recognised by the plates, thirteen in number, and not arranged like tiles, that cover the disk of the carapax, which is fawn colour, with a number of brown spots, glazed green. It is found in the Atlantic ocean, and feeds chiefly on a plant known to botanists under the name of *zostera marina:* it lays twice a year, about the months of May and June, and the total number of its eggs is about two hundred and fifty. Its length is sometimes from six to seven feet, and its weight from seven to eight hundred pounds. This species differs very little from other marine Tortoises, frequenting the same places, and is found on the coasts of Africa, and in the Asiatic seas. The flesh of all these Chelonians is very much esteemed. In England particularly it is very much sought as a luxurious dish, and to supply the London market, vessels are despatched to the Indian seas, and on certain coasts parks have been established for the preservation of Sea Tortoises. The fat of these animals, although of a greenish hue, which may be at first unpleasant, has a very delicate taste, and their eggs are equally esteemed.

33. The *Caouane,—Testudo caretta,*—as in the Green Tortoise, the carapax is covered by plates simply placed together, but the number of these scales on the disk is fifteen instead of thirteen.

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30. Where are marine Tortoises found?

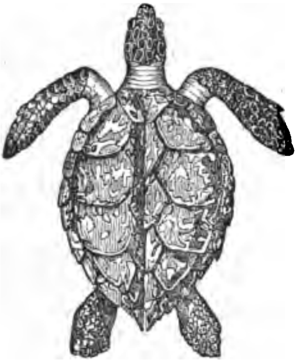
31. How are Sea Tortoises classified?

32. What are the characters of Green Tortoises? Upon what do they feed?

33. What is the Caouane?

The head is also larger, and its colour is brown or deep chestnut. It inhabits the Mediterranean, as well as the Atlantic ocean; it does not attain the same size as the preceding. Its length is about four feet, and its weight from three to four hundred pounds. It is very voracious; its food consists chiefly of mollusks, and its flesh is not good. Its fat is burned for light.

Fig. 9.



34. The *Hawks-bill Turtle*—(the Caret)—*Testudo imbricata*,—(*Fig.* 9.) is the most interesting species of this genus; because it furnishes the tortoise shell. It is readily distinguished by the arrangement of the horny plates of its carapax, which, in place of being simply joined together, are extended backwards, one over the other like the tiles or shingles of a roof; we count fifteen on the disk; the colour is yellowish marble with a deep brown. The jaws are strong, elongated and curved towards the extremity, but without teeth on the edges; the extremities or fins, like those of the caouane, are provided with two nails, while in the Green Tortoise there is but one. Its size scarcely exceeds one third of that of the last named Chelonian; it feeds chiefly on marine plants, but also eats crustacea, mollusca, and small fishes. It is met in the Indian ocean as well as in the American seas, and, in the laying season, resorts to the same localities as the preceding species. At the Tortugas, for example, it arrives in June, and lays a second time in August. The total number of its eggs is about two hundred: they are said to be good food; but the flesh of this Tortoise is bad, and it is only on account of its shell that it is sought.

35. The *scale* or *shell* which covers the carapax of the Hawks-bill is a substance which is extremely analogous to horn, but which is neither fibrous nor lamellar like it; it is as transparent; its hardness is greater, and it is capable of receiving and preserving the most beautiful polish; and it is very much esteemed in the manufacture of toys, &c. Each one of these Tortoises furnishes, on an average, from three to four pounds of these large scales, and to detach them, it is only necessary to expose the carapax before burning coals. It is brought to market without

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34. What is the Hawks-bill Turtle? For what is it most valued?
35. What is Tortoise shell? How is it obtained?

any other preparation, and is known as *rough tortoise shell*, which is afterwards manufactured in the same manner as horn. By softening it by the action of hot water, and afterwards pressing, it can be spread out, soldered or moulded into any required shape. What is termed *run*, or *cast shell*, is obtained by agglutinating, by a similar process, the scrapings and powder, detached from the ordinary shell, in fashioning, or giving it the desired dimensions.

36. The marine Tortoises, designated under the name of SPHARGIS, have no covering composed of horny plates, but one of a coriaceous skin, similar to leather. Only one species is known, the *Luth*, which is found in the Mediterranean, and the Atlantic; it attains seven or eight feet in length.

LESSON III.

ORDER OF SAURIA.—*Organization.—Classification.*

FAMILY OF CROCODILIDA. — *Circulation. — Habits. — Crocodiles properly so called.—Alligators.*

FAMILY OF LACERTINIDA.—*Characters.—Monitors.—Lizards.*

FAMILY OF IGUANIDA. — *Characters. — Dragons. — Iguanas. — Basilisks.*

FAMILY OF GECKOTIDA.—*Characters.—Habits.*

FAMILY OF CHAMÆLEONIDA.—*Characters.—Common Chameleon.*

FAMILY OF SCINCOIDEA—*Characters—Scinques—Fossil Saurians.*

ORDER OF OPHIDIA, or Serpents.—*Characters.*

FAMILY OF ANGUINA.—*Characters.*

FAMILY OF SERPENTIA, or True Serpents.—*Coluber.—Boa.—Venomous Serpents.—Rattle Snake.—Trigonocephalus.—Vipers.—Naia, or Asps.—Effects and treatment of the bites of Vipers, &c.*

FAMILY OF NUDA.—*Characters.*

ORDER OF SAURIANS.

1. The order of Sauria comprises all reptiles that resemble lizards in their general conformation. Animals of this order always have an elongated body, terminated by a tail of greater or less length, and provided with extremities, which, with some exceptions, are four in number.

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36. How are the Tortoises of the genus Sphargis characterised?

1. What is the general character of animals included in the order of Sauria?

2. Their extremities are short, and placed unfavourably for rapid movement. In general, they are wide apart, and directed outwards at a right angle with the body, so that they cannot sustain the weight of the trunk: most of these reptiles drag the belly and tail on the ground. The toes, which are very distinct, and ordinarily five in number, terminate in sharp, curved nails; sometimes they are very long and slender, at others, widened, and furnished beneath with folds variously arranged, and at other times again, united by palmate membranes, which modifications are in conformity with the animal's mode of life.

3. The skeleton has no important remarkable peculiarity. The number of vertebræ is very variable, particularly in the caudal region: there always exist moveable ribs which often protect the abdomen as well as the thorax. The sternum is never wanting. The shoulder is ordinarily formed of three bones, (a scapula, a clavicle, and a coracoid bone,) united in a kind of ring, so as to envelope the anterior part of the chest, and all concur in the formation of the cavity designed to lodge the head of the humerus. The pelvis is also composed of three pieces, and is joined to the sacrum, which consists of two vertebræ.

4. The skin of these animals is always covered by a thick and unequal epidermic layer, which forms scales or plates of greater or less size.

5. The mouth, which is deeply cleft, is without fleshy lips; it is armed with teeth, generally of a conical form, that serve to seize and hold their prey, but rarely to grind their food. They are often found in the palate, as well as in the two jaws. The food of Saurians consists essentially of animal substances; the digestive canal is ordinarily quite short; in general, the stomach is scarcely distinguishable from the œsophagus; but sometimes it has the form of a more or less globular pouch.

6. The disposition of the circulatory system, varies in these animals; in general, the heart is but imperfectly divided in its ventricular portion, so that the venous blood and arterial blood mingle in its interior; but in crocodiles, the separation between the two halves of this organ is complete, and the mixture of the two kinds of blood takes place only in the descending aorta.

7. The lungs, in general, are large, and extend more or less into the abdomen. The air is renewed in them by the same

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2. What is the character of their extremities?

3. What is remarkable in the skeleton of Sauria?

4. What is the character of the skin of Sauria?

5. What is the character and situation of the teeth in Sauria?

6. Is the circulation of the blood the same in all Sauria? What are its general characters?

7. How do the Saurian's breathe?

mechanism as in mammals and birds, that is, by the alternate dilatation and contraction of the cavity of the thorax, effected by the action of the ribs.

8. The order of Saurians may be divided into six families, namely: *Crocodilians*, *Lacertians*, *Chameleonians*, *Iguanians*, *Geckotians*, and *Scincoidians*, which may be distinguished by the following characters:

SAURIANS,

- Having four toes on the hind, and five on the fore feet; tail compressed; tongue not extensile, and the heart with four distinct cavities. — CROCODILIANS.
- In general, having five toes throughout, and always the same number on the anterior and posterior paws; the heart with but three cavities.
  - Tongue very extensile.
    - bifid at the end; toes free; tail not prehensile. — LACERTIANS.
    - terminated by a fleshy cylinder; toes united in two opposable parcels; tail prehensile. — CHAMELEONIANS.
  - Tongue not extensile.
    - Paws quite long; body neither fusiform, nor vermiform.
      - Toes unequal, and not widened at the end; body light. — IGUANIANS.
      - Toes equal, and almost always widened at the end, in form of a disk, or fan; body squat. — GECKOTIANS.
    - Paws in general, very short, and often only two in number; body fusiform, or like that of a serpent. — SCINCOIDIANS.

Certain fossil reptiles, which cannot be classed in any one of the above families, are also referred to this order: some of them were formed for swimming exclusively, and others for flight.

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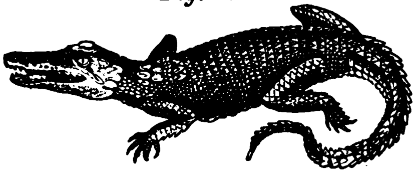
8. What is the division of the order of Sauria ?

FAMILY OF CROCODILIANS.

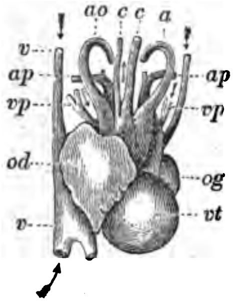
Fig. 10



CROCODILE OF THE NILE.

9. Crocodiles differ in so many respects from other Saurians, that many authors think they ought to constitute a separate order. Their internal organization seems to place them as a connecting link between reptiles and the higher vertebrata. They are very easily recognised by their laterally compressed tail, and by their toes, five before, and four behind, all of them more or less united by membranes, which is indicative of aquatic habits.

Fig. 11.



10. The most remarkable peculiarity in the structure of these animals, is the disposition of their circulatory system: it is such that the whole posterior part of the body receives only a mixture of arterial and venous blood, while the head is supplied with pure arterial blood. The heart has four cavities, two auricles, and two distinct ventricles, as in mammals and birds. The arterial blood, coming from the lungs, passes from the left auricle into the ventricle of the same side, which in its turn, sends the blood into the aorta, (*Fig.* 11.) The venous blood, received into the right ventricle, finds no direct passage into the left ventricle, as is the case in other reptiles; but it does not all go to the lungs, as it does in the warm-blooded vertebrata; for, alongside of the pulmonary arteries, (*ap.*) is found another vessel, (*a.*) which also arises from the right ventricle, and which, after bending backwards behind the heart, terminates in the

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Explanation of Fig. 11.—Heart and great vessels of a crocodile:—*v*, *v*, veins which bring the blood from different parts of the body to the right auricle of the heart, (*od*,)—*vt*, the two ventricles which are separated internally by a partition,—*ap*, the two pulmonary arteries which go from the right ventricle to the lungs,—*a*, the vessel which arises from the same ventricle, and empties into the descending aorta,—*vp*, pulmonary veins which convey the arterial blood from the lungs to the left auricle, (*og*,) from which it descends into the left ventricle, and directly enters the aorta, (*ao*,) and the two arteries, (*c*, *c*,) which are distributed to the head, &c.

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9. What are the general characters of the crocodiles?
10. What are the peculiarities in the circulation in crocodiles?

descending aorta, (*ao.*) It follows, therefore, that at every contraction of the heart, one portion of venous blood is sent to the lungs, and another portion is mingled with the arterial blood; but this mixture takes place in the interior of the aorta, below the point of origin of those branches, (*c,c.*) which this vessel sends to the head and anterior part of the trunk, so that these parts receive pure arterial blood, while all those, the arteries of which arise posteriorly to the point of junction between the aorta and the vessel coming from the right ventricle, receive only a mixture of red and black blood.

11. The lungs of Crocodiles do not extend into the abdomen, like those of other reptiles, and are separated from its viscera by a sort of imperfect diaphragm. It is also to be remarked, that the canal through which the air penetrates to these organs, can be completely separated from the mouth by letting down a fold, analogous to the veil of the palate in mammals, an arrangement, which permits them to remain under water, with the mouth open, to await their prey, without interrupting their respiration. And their nostrils, which open at the extremity of the muzzle, are closed by valves.

12. Their mouth is cleft beyond the ears, and the lower jaw is prolonged backwards beyond the cranium, which makes the upper one seem to be moveable; but it only moves with the cranium. There is, in each jaw, a single row of very strong, pointed teeth, planted in distinct alveoli. The tongue is fleshy, flat, and attached to the lower jaw, very close to its edges, and hardly distinct from it, which led the ancients to believe that it was entirely wanting. The stomach is in the form of a rounded pouch.

13. The skeleton also, has several peculiarities. The cervical vertebræ rest one on the other through the medium of small false ribs, which renders lateral motion difficult. Besides the ordinary ribs, there is found, between the muscles of the abdomen, analogous bones, which protect the viscera without extending to the dorsal spine; these reptiles are the only Saurians that want clavicles, properly so called.

14. Crocodiles are large animals; their back is covered by large, square, very strong scales which are carenate (ridged,) in the middle. The tail has a similar covering, and is furnished on top with a strongly notched crest which is double at its base; the

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11. What are the peculiarities of the respiratory organs in Crocodiles?

12. Do Crocodiles move the upper jaw? What is remarkable in the lower jaw? What is the character of their teeth? Have Crocodiles a tongue? What are its peculiarities?

13. What are the peculiarities of the skeleton?

14. What is the character of the integuments of Crocodiles?

plates on the belly are thin, smooth, and square, and arranged in transverse bands.

15. These large and powerful animals inhabit the hottest parts of both continents, and ordinarily keep in fresh water rivers and lakes. Their gait is usually slow; though they can swim with extreme rapidity, and run very swiftly in a straight line, but, owing to the disposition of the vertebræ of the neck, it is difficult for them to change their direction: hence, it is easy to avoid them by turning or running around them. They are very carnivorous, and formidable even for man. They cannot swallow in the water; but they generally drag their prey there to drown, and, it is said, they deposit it in some hole to putrify before eating it.

16. These animals, notwithstanding, they are so formidable, and so well furnished with protective armour, have foes to dread, and these enemies are feeble insects, a sort of ant, which introduce themselves into their mouth, in immense numbers, the moment they go on shore, and torment them with their stings; but, what is very singular, little birds often come to deliver them from this scourge, and enter their great mouth without fear, in pursuit of the insects. This fact, observed by Herodotus, and afterwards treated as a fable, has been confirmed in modern times, by Geoffroy Saint Hilaire, who accompanied the Emperor Napoleon in Egypt. A species of Plover performs this interesting service for the crocodile of the Nile, and in the West Indies, the Tody has a similar habit.

17. The family of crocodilida is composed of three genera, namely: *Crocodiles properly so called*, *Caimans*, or *Alligators*, and *Gavials*:

Crocodilians, having the muzzle	wide, and the whole head oblong; the upper jaw	simply notched on each side to receive the fourth tooth of the lower jaw.	Crocodiles Properly so called.
		with a hole on each side to receive the fourth tooth of the lower jaw.	Caimans.
	slender, and very much elongated,		Gavials.

18. Crocodiles properly so called,—*Crocodilus*,—have an oblong and depressed muzzle, unequal teeth, and the upper jaw

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15. What regions do Crocodiles inhabit?
16. What are the great enemies of Crocodiles?
17. What genera compose the family of Crocodilians?
18. What are the general characters of Crocodiles properly so called? Where are they found? What are their habits?

notched on each side to receive the fourth lower tooth, when the mouth is shut. The most celebrated and longest known species, is the *Crocodile of the Nile*, an animal that is sometimes twenty-five, and even thirty feet in length: it is bronze green, spotted and marbled with brown above, yellowish green below, and is distinguished by the square plates nearly equal in size, which form six rows along the back. We find from Senegal to the Ganges, and even beyond it, Crocodiles very similar to that of the Nile, which seem to be only varieties of this species. Formerly this reptile descended the Nile to its delta, and according to Pliny, passed the four winter months there, in caverns; but in our time, it never quits Upper Egypt, where it does not hibernate. The Ancient Egyptians, particularly the inhabitants of Thebes, and the environs of the lake Mœris, rendered great honours to these reptiles; they even made them objects of religious worship, and embalmed their dead bodies. At Arsinoë, the priests raised one of these reptiles, which they kept in a temple, and adorned with jewels, and fed with great care.

19. Crocodiles properly so called, also exist in America: the *Caiman* of Saint Domingo, and other parts of the West Indies, belongs to this genus, and has received the name of *Crocodilus acutus*, or sharp nosed Crocodile, from the form of its head: it has four rows of plates on its back, and its length sometimes exceeds sixteen feet. It is a fierce and dangerous animal. At birth, the young are from nine to ten inches long, and growth continues for twenty years.

20. The Caimans, or Alligators, are readily distinguished from Crocodiles properly so called, by the disposition of the fourth tooth of the lower jaw, which, when the mouth is closed, is lodged in a hole, and not in a notch of the upper jaw. Their hind feet, in place of being notched on the external edge, and palmate to the end of the toes, are unprovided with notches, and are only semi-palmate. Many species are known, but all seem to belong to America. One of them, the Pike-nosed Alligator,—*Crocodilus lucius*,—inhabits the southern parts of North America, and, during the season of ice, buries itself in the mud, and remains benumbed until the return of a milder temperature. In Guiana and Brazil, there is another, the Spectacle Alligator,—*Crocodilus sclerops*,—so called from the ridge which unites the projecting edges of the orbits in front. Like other Crocodiles, the last lays its eggs in the sand; but covers them with straw or leaves, and instead of abandoning them, defends them courageously; it is from twelve to fifteen feet in length, and rarely attacks man.

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19. Are there any Crocodiles in America?
20. How are Alligators distinguished from Crocodiles?

21. The **Gavials** differ from the two preceding genera in their very long slender muzzle, as well as in their teeth, which are nearly equal. They are only met with on the eastern continent. The most common is the *Gavial of the Ganges,—Lacerta gangetica,*—which is said to attain thirty feet in length, but is not dangerous either to man or large animals; it feeds exclusively on fishes.

FAMILY OF LACERTIANS.

22. The Lacertians have five distinct toes on all their feet, armed with nails; the tongue is thin, extensile and terminated by two threads: their scales are arranged in transverse and parallel bands around the tail, and under the belly, some have teeth in the jaws only, and others have them also in the palate. The first form the tribe of *Monitors*, and the second that of *Lizards*.

23. The **Monitors** generally have a laterally compressed tail, like that of the Crocodile. Monitors properly so called are recognised by the small scales that cover the head, limbs and whole body. Two species are found in Egypt: one, the *Monitor of the Nile,—Lacerta nilotica,*—is five or six feet long, and is seen sculptured on the monuments of the ancient Egyptians; the other, called the *Land Monitor of Egypt*, on account of its terrestrial habits, is common in the deserts, in the vicinity of that country.

24. Other Monitors, called Sauvegardes, have the top of the head furnished with angular plates; and the belly and tail are covered with large rectangular scales.

25. The **Tribe of Lizards**, is composed of Lizards properly so called, and some similar genera, in which the palate is armed with two rows of teeth, and the tail is cylindrical. Most of them are also distinguished by a sort of collar, placed under the neck and formed of a transverse range of large scales, separated from those of the chest, by a space covered only by granulations. In general, they have also, under each thigh, a longitudinal series of projecting pores, and the whole top of the head is armed with a bony shield, which is covered by large horny plates.

26. **Lizards properly so called,**—*Lacerta,*—have the top of the body covered by small scales similar to granulations, while beneath the belly they have large transverse plates. These

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21. How do Gavials differ from other Crocodiles?
22. What are the general characters of the Lacertians?
23. How are Monitors recognised?
24. What are Sauvegardes?
25. What are the general characters of the tribe of Lizards?
26. How are Lizards properly so called characterised? What are their habits? Upon what do they feed? Are they poisonous?

animals are agile, light, and elegant in form; they feed principally on insects, and prefer living prey. In summer they eat a great deal; but they can easily support a fast of several weeks in summer, and four or five months in winter; when held in captivity, they generally refuse to take food; yet they bite at every thing presented to them, and close their jaws with considerable force. In our climate they pass the winter benumbed in holes, and their movements are active in proportion as the temperature is more elevated; they love to warm themselves in the sun even in midsummer, and they are often seen stretched on a stone basking in the sunshine. Many fables have been attached to these animals; some have pretended, without any reason, that they are venomous; others, without foundation, assert that they show a true attachment for man, and give him warning when a serpent is about to bite. A great many species are known.

FAMILY OF IGUANIANS.

27. The Saurians composing this family have very nearly the same general form as the Lacertians: they also have a long tail, free and unequal toes, &c.; but their tongue is fleshy, thick, not extensile, and only notched at the end.

28. The mouth presents the same modifications as the preceding family: sometimes they have teeth in the palate as well as in both jaws; sometimes there are only two ranges of teeth in the upper jaw.

29. Among the first are ranged the **Stellios**; they have the tail surrounded by large scales, which are often spiny; the **Agamians**, in which the scales on the tail are *imbricate*, (that is, having the scales lying over each other like shingles on a roof,) and not *verticillate*, (that is, not arranged in a circle, around a centre); the **Dragons**, &c. The last are distinguished from all other reptiles by a species of wing formed on each side by a deep fold of the skin. These appendices resemble the wings of a bat; but instead of being supported and set in motion by the extremities, they are altogether independent of them, and are sustained by the first six false ribs which do not surround the abdomen, but are extended horizontally in a straight line. The animal uses these wings as a parachute, to sustain itself in the air when it leaps from branch to branch; but it cannot use them with sufficient force to fly like a bat or a bird. These singular reptiles,

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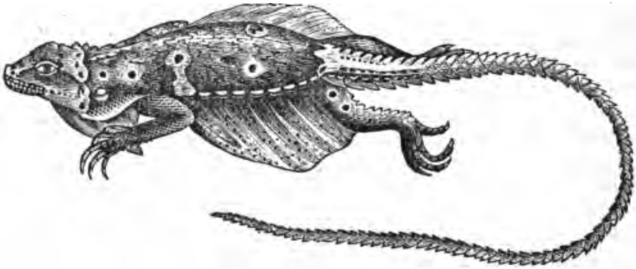
27. What are the general characters of the Iguanians?

28. What are the modifications met with in the mouth?

29. What are Stellios? What are Agamians? How are the Dragons characterised?

which inhabit India, realize to a certain extent the fable of flying lizards, or serpents, spoken of by certain ancient writers; but the Dragons of zoologists, instead of being formidable animals, like those of the poets, are of very small size, and only attack insects.

Fig. 12.



DRAGON.

30. As examples of Iguanians with palatine teeth, we will mention, Iguanas properly so called, Basilisks, and Anolis. The first are covered by small imbricated scales, and have a crest of pointed scales along the back. There is also observed beneath the throat, a pendent and compressed dew-lap. Several species are known which inhabit America; one, four or five feet in length, is common in all the hot regions of the New World: it lives mostly on trees and feeds on fruits, leaves, &c. Its flesh is reputed delicate, but unwholesome.

31. The Basilisks,—*Basiliscus*,—have along the back and tail, a continued, elevated crest, which is supported by the spinous processes of the vertebræ; they feed on grains, and inhabit Guiana.

32. The Anolis,—*Anolius*,—which also belong to America, are distinguished by the conformation of their toes, the antepenultimate joint of which is furnished on the under part, with an oval, striated disk, by the assistance of which these reptiles cling to the surface upon which they climb. Many of them possess the power of changing the colour of their skin.

To the family of Iguanas also belongs an enormous reptile, called *Mosasaurus*, the fossil bones of which have been found at Maestricht.

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30. What are Iguanas properly so called? What are their habits?
31. What are Basilisks?
32. How are the Anolis characterised?

FAMILY OF GECKOTIANS.

33. The Saurians designated under the collective name of *Geckos*, are nocturnal animals, dull and heavy in appearance; their walk is crawling, and their squat and flattened form is in striking contrast with that of most of the reptiles we have heretofore mentioned. Their head is wide and depressed; their eyes are very large, and very prominent; their jaws are armed all round with a single row of small teeth; but there are none in the palate. Their tongue is fleshy, and not extensile; the body is studded above by small granular scales, among which are larger tubercles, (the whole resembling shagreen,) and covered beneath by flat, imbricated scales; their feet are moderate in size, and their five, almost equal toes, are ordinarily widened throughout, or in part, armed with retractile nails, and furnished beneath with a fold of skin, by the aid of which they adhere to bodies upon which they walk. This conformation of the toes enables them to walk easily on the smoothest walls, and even upon ceilings. During the day, they conceal themselves in obscure places, and, at night, more especially, they seek spiders, and other animals upon which they feed. The ugliness of these reptiles is extreme, and we are assured, that the contact of their feet on our skin, often excites a sort of inflammation: they are everywhere objects of aversion, and they are charged with being venomous, but this opinion is not sustained by positive proof.

The Geckos are very numerous, and disseminated throughout the warm parts of both continents.

FAMILY OF CHAMELEONS.

Fig. 13.

34. The Chameleons,—*Chamæleo*,—are distinguished from all other Saurians by their toes, which are five in number on all their feet, but divided into two opposable parcels or bundles, an arrangement which makes these animals essentially climbers, destined to live on the branches of trees, (*Fig.* 13.) A number of peculiarities of organization separates them from all the reptiles we have thus far considered. Their tail, round and prehensile, serves them as a fifth extremity, in suspending themselves from branches, and aids them in their slow and awkward movements. Their

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33. What are Geckos? What are their general characters?

34. What are the distinguishing characters of Chameleons? Upon what do they feed? How does the Chameleon change its colour? What are the peculiarities of the skin in Chameleons?

eyes, which are very large and very projecting, are almost entirely covered by the skin; the light reaches them only through a little hole, situate opposite to the pupil, and these organs move altogether independently of each other. Their mouth is armed with small tri-lobed teeth, and their tongue, fleshy and cylindrical, is extremely extensile: they can dart it out of the mouth to a distance that sometimes exceeds the length of the body, and they use it to seize living insects upon which they feed. Their body is compressed, and the back is ridged, or, as it were, trenchant, and the skin is covered by small scaly granulations. These singular animals are celebrated for their faculty of almost instantly changing colour; and, if we believe the ancient writers, they even possess the power of assuming successively, the hues of all the objects by which they are surrounded, in order to conceal themselves more effectually from their enemies. The observations of naturalists have already robbed the history of the Chameleon of the fables with which it was loaded; and, although the faculty of changing its colours, in this manner, has been denied, it has been ascertained that it really undergoes the most remarkable changes, being sometimes almost white, sometimes yellowish, at other times green, reddish, and even almost black, either entirely or only on parts of the body. These changes are particularly observed, when the animal is excited either by anger or by heat. When it has remained for some time in a dark, cold place, it is almost white, and warming it, or stimulating it, causes it to assume a bottle green, or vinous red hue, which often becomes so intense that it appears to be almost black. For a long time, these changes were attributed to the greater or less distension of the very large lungs of this animal, and to corresponding modifications in the quantity of blood sent to the skin; but we are assured, there is no necessary relation between these phenomena; and dissection of the skin teaches us that we must seek the cause of these variations of colour in the particular mode of the structure of this membrane. We find, in fact, that it contains different colouring matters, some of which can sometimes rise to the surface, and in a degree mask the others, and at other times retire, and become hidden beneath the superficial pigment.

35. Only a single genus of Saurians, possessing the above described organization, is known; but many species of Chameleons have been ascertained. One of them, very common in the neighbourhood of Algiers, is met with from Spain to the Indies.

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35. How many genera of Chameleons are known?

FAMILY OF SCINCOIDEA.

36. The Saurians which compose this family are recognised by their short feet, their tongue, which is slightly or not at all extensible, and by the equal, and ordinarily imbricated scales, which cover the body above and below. Some of them are spindle-shaped, and others have the body so much elongated, and the tail not very distinguishable from it, (*Fig.* 14.) that they resemble serpents. In many, the feet are too short to serve for locomotion, and there are some in which one pair of extremities, either the anterior or posterior, is entirely wanting. The Scincoidea evidently form the connecting link between the Saurians and Ophidians.

Fig. 14.

37. Among the Scincoidea we place the Scinques, the Seps, the Bipedes, the Chalcides, and the Bimana. In the two first genera there are four feet, and in the Seps the body is more elongated, and more vermiform than in the Scinques. The Bipedes, (*Fig.* 14) and Chalcides, want the anterior extremities, and the Bimana have the fore feet only.

38. Long previous to the epoch of the creation of man, there existed on the surface of the globe, a great number of gigantic reptiles, the bones of which are found in a fossil state. Among these Saurians, the race of which is extinct, are found Lacertians, resembling Monitors, that must have been from thirty to forty feet in length; but many of these lost animals are particularly remarkable for their anomalous structure. In England, near Honfleur, and in other localities, we find in the very ancient formations, the remains of many species of two genera of Saurians, whose broad feet, in the form of battledores, indicate that these animals were entirely aquatic. They are designated under the names of Plesiaosurus, and Icthyosaurus. And another reptile, (*Fig.* 15.) still more extraordinary, has been discovered in some of the ancient layers of the earth. According to the structure of its bony frame, we see, like the bat, it must have been capable of walking and flying; for its posterior extremities, and all the toes of the fore feet, with a single exception, are formed in the ordinary way; but the second toe of the anterior extremities is more than twice as long

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36. How are the Scincoidea characterised?
37. What are the divisions of the Scincoidea?
38. What is the Pterodactylns?

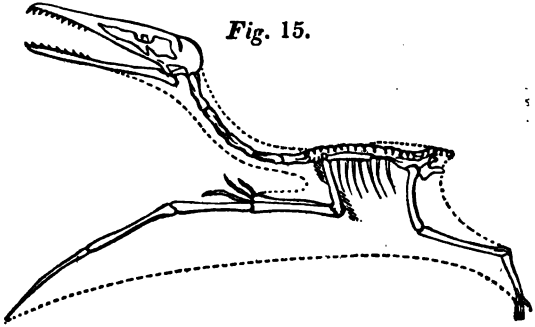

Fig. 15.

as the body, and probably sustained a fold of skin, fitted to perform the functions of wings.* To indicate this singular conformation, the generic name of PTERODACTYLUS has been given to these fossil Saurians.

ORDER OF OPHIDIANS, OR SERPENTS.

39. We ordinarily group with Serpents, or Ophidians, all reptiles that have a cylindrical, elongated body, without extremities; but in order that the classification of these animals may represent the modifications introduced by nature in their organization, and indicate the degree of physiological importance of these differences, it becomes necessary to separate from the serpents, some apodous reptiles in which respiration is at first branchial, then pulmonary, as it is in ordinary Batrachians. On the other hand, the passage between the Saurians and Ophidians is so gradual, that the limits between these two orders are somewhat arbitrary. Some naturalists even think, they should not be separated, and, according to others, it would be proper to range in the division of Saurians, those reptiles that, by their internal organization, are removed from the common type of Ophidians, and approach that of the Scincoidea.

40. The apodous reptiles, which are in a manner intermediate between the Saurians and the Serpents properly so called, are

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* The dotted line indicates what it is presumed, was the outline of the animal.

39, What description of reptiles belong to the order of Ophidians.

40. What are the general characters of the Angues? What are their habits? Upon what do they feed? What are Glass-Snakes? What are the characters of the common Angue of Europe?

the SNAKES, or ANGUES,—*Anguina*. They are easily distinguished by the imbricate scales, which cover the body like those of the Scincoidea; they also approximate the Saurians by the presence of three eye-lids, organs that are not found in true serpents. The tongue is fleshy, and but slightly extensile, and the bony skull possesses the same conformation as that of the Scinques; and we find beneath the skin of most of these animals, vestiges of a pelvis and shoulder bones. On the other hand, they resemble true serpents in the general form of the body, and in the small size of their lungs. They are very mild animals, and, when taken hold of, do not attempt to bite. Their mouth is small, and armed with teeth like those of the Scincoidea; they feed on different insects and terrestrial mollusks, and entirely conceal themselves in holes, and are torpid in winter. Their tail, like that of lizards, breaks with the greatest facility, and some Angues stiffen themselves so much when taken that the body breaks, which singular circumstance has obtained for them the name of *Glass-snakes*. The *Common Angue* of Europe,—*Anguis fragilis*,—is about a foot long, and its tail, which is obtuse, and like the rest of the body, is of the same length as the latter. Its scales are smooth and shining; it is blackish beneath, and of a yellowish lead colour above, with three black bands, which, as it advances in age, change to a series of points, and finally disappear; it has no external tympanum. It digs subterraneous galleries, and produces its young like vipers, in which the eggs are hatched before they are laid.

41. The TRUE SERPENTS,—*Serpentia*,—possess no internal trace of anterior extremities: they have no vestige of sternum or shoulder; but many of them have, beneath the skin, rudiments of posterior extremities, which sometimes show themselves externally, in the form of a small hook. The skin is furnished with scales, which, in general, are small, and imbricate above, and in the form of broad quadrangular plates beneath: they have no tympanum, and their eyes appear to be entirely without lids; for they are only covered by a sort of single and immoveable veil, which is set in, like a watch-glass, in front of the orbit, and which permits the passage of light.

42. The vertebræ and ribs, by themselves, form almost the whole skeleton of serpents. Their number is very considerable; in the viper we count 198 vertebræ; in the Boa, 304; and in the Ringed Snake, 316. The form of these bones is nearly the same throughout the column, and their mode of articulation is very

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41. What kind of eye-lids have true Serpents? What are the general characters of Serpents?

42. What bones are most numerous in the skeleton of Serpents?

remarkable: the anterior part of the body of each vertebra presents a rounded semi-spherical tubercle which is received in a corresponding cavity on the posterior face of the vertebra next to it. This mode of articulation explains the movements of the body of these animals, which, in general, are executed laterally, and not from above downwards; in fact, the spinous processes which prevail along the back are ordinarily so disposed as to prevent the vertebral column from bending very much in this direction. The ribs surround a large part of the circumference of the trunk, and are wanting only on the caudal vertebræ. The first pair are smaller than the others; but they commence at the head, so that these animals have no neck. We count in some instances as many as 250 pairs.

43. Serpents are essentially carnivorous; they can endure abstinence for a long time; but, in general, when the opportunity occurs, they gorge the stomach with such a quantity of food, that, during digestion, they remain in a state of greater or less torpor: they do not chew their food; but their mouth is armed with hooked teeth, suited for retaining their prey. Their tongue is very extensible, and terminates in two long, semi-cartilaginous, and very moveable filaments. The digestive canal is very short, and the stomach is merely a slight dilatation of this tube.

44. The circulation is carried on in the same manner as in Tortoises and Saurians, except Crocodiles. The heart is composed of two auricles and a single ventricle, incompletely divided into two cavities, from each one of which arises an aorta, which joins its fellow behind this organ. The lungs are very unequal in size, and generally one of the two is entirely atrophied, while the other is very large, and prolonged into the abdomen, above and beyond the stomach and liver: it is in the form of a large membranous sack, in the interior of which are found great polygonal cells. The air is renewed in them by the motions of the ribs and abdominal muscles, nearly in the same way as it is in saurians and birds. Probably, it is in part owing to the position of the lungs that serpents become torpid after a copious repast; for, every time they swallow a prey of large size, this organ must be compressed, and the pulmonary circulation impeded.

45. The structure of the head varies in these animals. Sometimes the lower jaw, the two branches of which are solidly united in front, is supported on a tympanic bone, which is itself immedi-

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43. Upon what do Serpents feed? Do they chew their food? What is the character of their digestive organs?

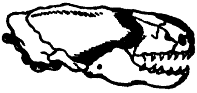
44. What are the peculiarities of the circulation in Serpents? What is the character of their respiratory apparatus? Why are Serpents torpid after a full meal?

45. Is the structure of the head the same in all these animals?

ately articulated with the cranium, as in Saurians and Chelonians, but, in general, the tympanic bones are moveable.

46. The true Serpents with immoveable tympanic bones also have the upper jaw fixed to the cranium, and the mouth but little dilatable, (*Fig.* 16.): they form the small family of *double walkers,—Amphisbæna,*— so called from their faculty of moving equally well, both forward and backwards. Those that form the genus of Amphisbæna have the body surrounded by circular ranges of small quadrangular scales, like certain Scincoids; the others, called Typhlops, have small imbricate scales, and at first sight, resemble earth worms. These Ophidians inhabit the warm countries of both continents: some of them are blind.

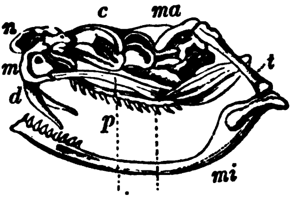
Fig. 16.*



47. True Serpents having moveable tympanic bones, form a more numerous family Some of them resemble the preceding in the cylindrical form of the head and body, and in the smallness of their scales. The mouth is less dilatable than in other ophidians of this division; for the tympanic bone is directly articulated to the cranium, while, in the last, it is suspended to a mastoid bone which is itself moveable. The genus of *Tortrix,* possesses this kind of organization.

48. In all the Ordinary Serpents, we have yet to mention, the mouth is so formed as to enable the animal to swallow bodies larger than itself. The two branches of the lower jaw are not united, and the kind of peduncle which sustains them (the tympanic bone, *Fig.* 17, *t.*) is not only moveable itself, but is suspended to another portion

Fig. 17.†



**Explanation of Fig.* 16.—The bony head of an Ophidian of the division of Amphisbæna.

†*Explanation of Fig.* 17.—Bony head of a Rattlesnake,—*c.* the cranium, —*ma.* the mastoid bone which articulates by one extremity, with the cranium, and by the other, supports the tympanic bone, (*t.*)—*mi.* the lower jaw suspended from the tympanic bone,—*n.* the vomer and nasal bones,—*m.* the moveable upper jaw bone,—*pi.* one of the pterygoid bones (portions of the sphenoid,) the internal of which is continuous with the palatine arches, —*p, pe.* palatine teeth.—*d.* the poisonous fangs.

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46. What are Amphisbænæ?

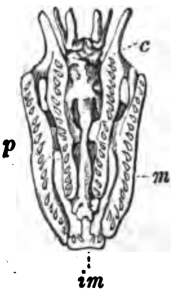
47. What is the organization of the head in the genus Tortrix?

48. What peculiarities in the structure of the head enable certain Serpents to swallow bodies larger than themselves?

of the temporal bone, called ***mastoid bone***, *(ma.)* which is also separate from the cranium, and attached to this bony case by ligaments and muscles only; the branches of the upper jaw are not fixed to the intermaxillary bone except by ligament, which permits them to separate more or less; the palatine arches also participate in this mobility. Another character, peculiar to this group, is the existence of sharp teeth, curved backwards, planted in these arches as well as in the upper and lower jaws.

49. In other respects the armature of the mouth varies, and these differences are of great importance; for they coincide with the existence or absence of an apparatus for the secretion of an active poison, which the animal uses to kill the prey it bites. Ordinary serpents are therefore divided into venomous serpents, and serpents which are not venomous.

Fig. 18.*



50. The Non-venomous Serpents, are recognised by their teeth, no one of which is moveable or hollowed by a canal or gutter; they are all fixed, and they form in the mouth four nearly equal ranges above, (*Fig.* 18.) and two below.

51. Those serpents that have the under part of the body and tail furnished with a single band of transverse scales are described under the name of Boas; and we give the collective name of Colubers to those in which the under part of the tail is covered by plates in pairs, divided on a middle line.

52. The division of Boas is composed of ***Boas properly so called***, of ***Erix***, &c.

53. The Boas properly so called, have a compressed body, a prehensile tail, a hook on each side of the anus and small scales on the back of the head at least. The largest serpents known, belong to this genus; certain species attain thirty and even forty feet in length, and manage to swallow deer, and, as we are assured, even oxen. They are unprovided with venom, but,

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**Explanation of Fig.* 18.—The bony head of a Non-venomous Serpent seen from below:—*c.* the cranium,—*im.* the intermaxillary bone,—*m.* the maxillary bones,—*p.* the palatine bones.

49. Is the mouth, in all ordinary Serpents, armed in the same way? How are ordinary Serpents divided?

50. How are the Non-venomons Serpents recognised?

51. What are Boas? What are Colubers?

52. How is the division of Boas divided?

53. What are the characters of Boas properly so called? What are their habits? To what part of the world do Boas belong? What is the Divine Boa?

possessing great agility, and prodigious strength, they are not the less formidable. Concealed in the grass, or suspended by its tail from the branches of a tree in a pathway, or on the bank of a rivulet, the Boa watches an opportunity of seizing its prey, which it surrounds in its folds, and presses so strongly, that the animal is soon stifled, and its bones crushed. When the Serpent has, so to speak, kneaded its victim, it bathes it in slaver, and, enormously dilating its jaws, slowly swallows it. We are assured, that several days are required to swallow an entire animal, eaten in this way, and that a part of it is already digested before the whole has entered the mouth of the reptile. After a repast of this kind, Boas remain motionless in some retired spot, exhaling a fœtid odour. It is then easy to kill them, and it appears, their flesh is not a disagreeable aliment, for certain Indian tribes feed upon it. During a very long time, the greatest confusion pervaded the history of these great serpents, which were confounded with the Pythons. It was believed they were found in Africa and Asia, as well as in America; but it now seems to be certain, that they are peculiar to the western continent. The most celebrated species owes its name to an error of this kind. It was called the ***Divine Boa***, because what was said of certain large Colubers, which the negroes of Mozambique make objects of religious worship, was attributed to it. It seems that the Brazilians and even the ancient Mexicans, rendered it similar honours. This enormous reptile, which is also called the ***Boa Constrictor***, inhabits the warm and humid parts of America; its head is covered with small scales to the end of the muzzle, and it is easily recognised by a sort of chain-links, formed along the back, of hexagonal blackish spots, and others of a yellowish colour. Two other species, which inhabit the same countries attain nearly the same size: the ***Boa anaconda***, and the ***Boa aboma***.

54. The division of Colubers includes the ***Pythons***, the ***Colubers properly so called***, and many other genera.

55. The Pythons, are, as it were, the representatives of the Boas in the old world: they attain the same gigantic size, and are also furnished with hooks near the anus: they have narrow ventral plates; but those beneath the tail are double instead of being simple. It is to be remarked, however, that some of these serpents have the first, others the second plates of the tail simple, which seems to establish a gradual passage betwixt these two genera, the distinction of which, in other respects, is founded upon unimportant particulars. Be it as it may, to the Pythons must be referred all that has been said of the Boas of Africa and Asia.

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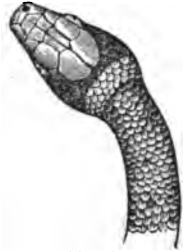
54. What genera are included in the division of Colubers?

55. What are Pythons? What are their characters?

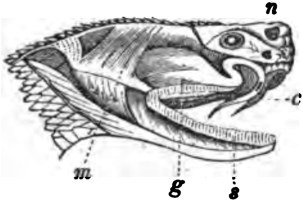
Fig. 19.



COLUBER.

56. The **Colubers properly so called**,—*Coluber*,—have the head covered by large plates, (*Fig.* 19.) and neither fossettes on the sides of the muzzle, nor hooks near the anus. The number of these Serpents is immense; the most common in France, (*Fig.* 19.) is the Ringed Snake,—*Coluber natrix*,—it is ash-coloured with black spots along the flanks, and three whitish spots form a collar around the neck. Its length is about three feet; it is found in the neighbourhood of stagnant waters. It swims with ease, and lives chiefly on insects, mollusks, and frogs; it does not attempt to bite, except when very much irritated, and the wound it inflicts is by no means dangerous. It is eaten in many French provinces.

Fig. 20.*



RATTLE SNAKE.

57. **Venomous Serpents** are provided with a particular gland, situate on each side of the head, which pours out the poison that it secretes, by an excretory duct, the extremity of which empties into one of the maxillary teeth of the upper jaw. This gland, (*Fig.* 20, *g.*) is placed beneath the temporal muscles, so as to be compressed when they contract, and this tooth which is larger than the others, is sometimes perforated by a canal, and at others, simply has a gutter on one side; but in either case, its duct is in communication with the excretory canal of the venomous gland, and serves to pour the poison into the bottom of the wound made by the tooth itself. This liquid is a most violent poison. It is neither acrid nor burning, and only produces a sensation on the tongue analogous to that occasioned by a fatty matter, and may be swallowed with impunity; but, introduced into a wound, in sufficient quantity, it causes death with frightful rapidity.

**Explanation of Fig.* 20.—Poison apparatus of a Rattlesnake:—*g.* the venomous gland, the excretory canal of which empties into a large moveable tooth, (*c*,)—*m.* the elevator muscles of the jaw which partly cover the gland and compress it,—*s.* salivary glands along the edge of the jaws,—*n.* the nostrils, beneath which is seen the fossette, or pit, which distinguishes these serpents and trigonocephali from the vipers.

56. What are the characters of Colubers properly so called? What are the characters of the Ringed Snake? What are its habits?

57. What peculiar apparatus distinguishes the venomous Serpents? What are the properties of their venom?

58. Its energy varies according to the species, and according to the condition of the serpent. The same species seems to be more dangerous in warm than in cold or temperate climates, and the effects are serious in proportion to the quantity of poison poured into the wound: these animals are more formidable when they have fasted for sometime, and the poison has accumulated in considerable quantity in the glands where it is secreted, than when they have just bitten several times, and only a small quantity of the liquid is left. It is remarked also that their poison does not act in the same manner on all animals. It appears that to Leeches, Snails, the Asp, the Coluber, and Angue, the venom of the Viper, for example, is not poisonous, while it kills all warm blooded animals, Lizards, and the Viper itself, with great rapidity. In general, the quantity of poison necessary to cause death is, all things being equal, large in proportion to the size of the animal wounded; thus, when the hundredth part of a grain of the poison of a Viper is sufficient to kill a Sparrow, it would require six times as much to kill a Pigeon.

59. This poison, to act on the animal economy, must be absorbed and carried into the circulation: therefore, in cases of bites of venomous serpents, we should hasten, by appropriate means, to prevent this absorption, so as to gain time to extract or destroy the poison, deposited at the bottom of the wound. Compression of the veins above the wound, between it and the heart, and the application of a cupping-glass over the wound itself, are the most appropriate means of retarding the absorption of the poison; but, to remove all danger completely, we should enlarge the wound, and cauterise the bottom of it, either with a red hot iron, or with some energetic caustic. Several internal remedies have been much vaunted, such as Ammonia, or Volatile Alkali, Arsenic, &c., but these means, though sometimes useful, should not inspire great confidence. The Indians of South America attribute still greater virtues to a plant of that country, known under the name of *Guaco*, or *Micania guaco;* they assure us that not only the application of the leaves of the Guaco to the bite of the most venomous serpents prevents all deleterious effects, but also that innoculation with the juice of this plant prevents these animals from biting persons so prepared. In support of this opinion the observations of Vergas, a Spanish author, and of Mutis are cited; and the celebrated and learned traveller, Baron Humboldt, thinks, according to some experiments, that

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58. Is the venom of Serpents equally active under all circumstances? When is it most to be dreaded?

59. What is the best mode of treating a person who has been bitten by a poisonous reptile?

the Guaco may impart to the skin an odour which is repugnant to the serpent and prevent it from biting.

60. Serpents with moveable, venomous fangs, are the most formidable. The fangs, (*Fig.* 20, *c.*) situate in front of the mouth, are isolated, very sharp, and pierced by a small canal, which opens near their extremity; they are fixed on very small maxillary bones, (*Fig.* 18, *im.*) and these bones being supported on a long pedicle, are very moveable, so that when the animal does not wish to use them, they are folded backwards, and lie concealed in a fold of the gum, and when required on the contrary, they are erected. There is one of these long teeth on each side, and behind each one, there are many germs to replace it, in the event of its being broken in a wound; but the intermaxillary bones support no other teeth, and, consequently, we find in the upper part of the mouth, only two rows of palatine teeth, instead of four rows, as in Colubers.

61. The head of these serpents is generally wide behind, and their aspect is more fierce than that of the preceding. They are all *ovo-viviparous*, that is, they are born alive, because their eggs are hatched before they are laid. Hence the name of *Viper*, which is a contraction of *viviparous*, is given to most of them.

62. The most remarkable genera of this division of venomous Serpents, are the *Crotalus*, *Trigonocephalus*, *Viper*, and *Naja*.

Fig. 21.

RATTLE SNAKE.

63. The Rattle Snakes,—*Crotalus*,—owe their name to a singular apparatus which terminates the tail, and which distinguishes them from all other Ophidians. It consists of a series of horny scales, loosely fitting into each other like a nest of boxes, which move, vibrate and sound, when the animal moves its tail, (*Fig.* 21.) The number of these scales increases with age; it seems there is an additional one after each moult, and that they are formed by the epidermis of the Serpent, turned upon itself like the finger of a glove, and retained at the extremity of the tail. This instrument vibrates with extreme

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60. What are the peculiarities of the fangs, in venomous Serpents?
61. What is the origin of the name of Viper?
62. What are the chief genera of the division of venomous Serpents?
63. What peculiarity gives name to the Rattle Snake?

rapidity, and thus produces a noise sufficiently loud to be heard at a distance of several fathoms.

64. Rattle Snakes attain a length of five or six feet, and even more: they inhabit America, and are celebrated for the violence of their poison. In general, they do not bite except when provoked, and they rarely attack animals too large for them to swallow. Notwithstanding that their food chiefly consists of birds, squirrels, &c., they do not climb upon trees. It was believed for a long time that they possessed the power of stupifying their victims by their breath, or even charming them by their gaze, and thus forcing them to enter their mouth; but it is only the extreme terror they inspire in small animals, which confounds them so much as to prevent their flight, causing them to perform irregular movements, and even to fall into the jaws of their enemy. These serpents ordinarily keep themselves coiled spirally, near a watering-place, frequented by small mammals. There they tranquilly wait, until some victim presents itself, and, when within reach, they spring upon it with the rapidity of lightning. In parts of North America, where the winter is rigorous, they are benumbed during winter, and, we are assured, that during the cold season, their bite is not dangerous. In Cayenne, and other warm countries, they are never benumbed. Negroes eat their flesh.

65. Many species of Rattle Snake are known: most of them have the head covered with scales like those on the back; that which is most common in the United States, is brown, with irregular, transverse, blackish bands; that of Guiana has lozenge shaped spots, bordered with black. Both are about six feet in length.

66. The TRIGONOCEPHALI are distinguished from the preceding by the absence of the rattle; but like them they have the fossette or pit, behind the nostrils. Some of them have simple, subcaudal plates, like the Boas and Rattle Snakes; others have the tail furnished beneath with double plates like the Colubers, and most Vipers. They equal the Rattle Snakes in the violence of their poison, and most of them inhabit the western continent. The most celebrated species is the *Yellow Trigonocephalus*, also called the *Yellow Snake of the West Indies*, and *Lance-headed Viper*,—*Trigonocephalus lanceolatus*. This reptile is very common in Martinique and the neighbouring Islands. It lives among

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64. What are the habits of the Rattlesnake? Where are Rattle Snakes usually met with?

65. Is there more than one species of the Rattle Snake?

66. How are the Trigonocephali distinguished from Rattle Snakes? What is the Lance-headed Viper? Where is it found? What are its habits?

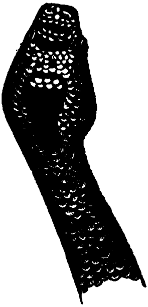
sugar-canes, where it feeds on rats, and causes the death of many slaves. Its length is from six to seven feet, and it is extremely active; it climbs the highest trees in pursuit of its prey, and springs like lightning, not only on birds and other small animals upon which it ordinarily feeds, but also on large animals, and even on man.

Fig. 22.

HEAD OF A VIPER.

67. The VIPERS,—*Vipera*,—differ from the venomous serpents just mentioned, by the absence of the pits behind the nostrils. Many of them have been frequently confounded with the Colubers, on account of their double, sub-caudal plates, and some of them having the head furnished with large plates like the latter; but most all Vipers have the head covered by small imbricated or granular scales, (*Fig.* 22.) The *Common Viper*,—*Vipera berus*,—possesses this latter character. It rarely exceeds two feet in length, (*Fig.* 23.) and is generally brown with a double row of transverse, black spots along the back, and another row upon the flank; but these spots are often united, forming zig-zag bands. One of these Vipers is sometimes named the Asp, in some parts of France, but it should not be confounded with the true Asp of the ancients. It inhabits the mountainous, stony and woody districts of temperate and Southern Europe. It feeds on mice, moles, young birds, reptiles, and even insects and worms. During the cold season, these reptiles remain benumbed in holes, where several are often found twined together. They are most frequently seen on the first fine days of spring, warming themselves in the sunshine; but when the weather becomes very hot, they are rarely met. They produce from twelve to twenty-five young ones at each birth, which do not acquire their full size until they are six or seven years old. Of all the venomous reptiles of Europe, the common Viper is the most dangerous; even in the climate of France, its bite may cause the death of a man in a few hours, and kill small animals in a few minutes. The quantity of poison it generally pours into a wound is not sufficient to be fatal to man.

Fig. 23.



VIPER.

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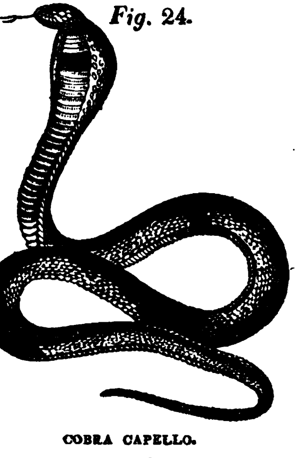
67. How are Vipers distinguished from the venomous Serpents just spoken of? What are the characters of the common Viper? What are its habits?

68. The *Little Viper,*—*Vipera chersœa,*—which is common in the north of Europe, and which is also found in the Pyrennes, has upon the head three plates somewhat larger than the scales surrounding them. It is about six inches long; but its poison is very violent.

69. The *Vipera illyrica,* inhabits the south of Europe, and is distinguished from the common Viper by a small soft horn, covered with scales, that it has on the end of the muzzle; and the *Horned Viper,*—*Coluber cerastes,*—of which the ancients often speak, is recognised by a small horn placed on each eyebrow. It is found in the burning sands of Egypt and Syria.

70. The NAJA resemble the Vipers, except that their head is always furnished with plates, and the anterior ribs can be erected and carried forward, so as to dilate this part of the trunk into a kind of disk, which is more or less wide, (*Fig.* 24.) Two species of this genus are known; the *Spectacle Snake,* and the *Asp of Egypt.*

Fig. 24.



COBRA CAPELLO.

71. The *Spectacle Snake,* (or *Cobra Capello* of the Portuguese in India,)—*Coluber naja,*—owes its name to a black line, in form of a pair of spectacles, traced upon the extensible part of its neck. Its length is about four feet; its bite is extremely dangerous, and it is very fierce: nevertheless, Indian jugglers teach it to execute certain movements, in time, to the sound of a flute, and employ it to astonish the public; to increase the sale of their pretended specific against the venom of this reptile, they permit themselves even to be bitten by the serpent, somewhat tamed, however; but they take the precaution previously to extract its poisonous fangs.

72. The Asp, which inhabits Egypt,—*Coluber haje,*—and which is about two feet long, is also employed by the jugglers of those countries to amuse the public. By pressing it with the fingers on the back of the neck, they cause it to fall into a sort

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68. What is the Little Viper?
69. How is the Horned Viper recognised?
70. What are the characters of the genus Naja?
71. What are the characters of the Cobra Capello?
72. What are the peculiarities of the Asp of Cleopatra?

of catalepsy, which renders it stiff and immoveable, as if they had changed it into a rod or stick. Its poison is very active, and Galen relates that, at Alexandria, they resorted to the bite of this serpent to abridge the punishment of criminals condemned to death. It is unquestionably the *Asp of Cleopatra.* The ancient Egyptians took it as the emblem of the protecting divinity of the world, and sculptured it on their monuments, on opposite sides of a globe. Its habit of erecting itself, when approached, led them to believe that it watched the fields in which it was found.

73. Other venomous serpents with isolated fangs, called ELAPS, have a mouth that is hardly dilatable; and there are some, in which the tail is compressed in the form of a paddle, whose habits are aquatic. They form the genus of PLATURUS.

74. Among the VENOMOUS SERPENTS WITHOUT ISOLATED FANGS, there are some which are scarcely distinguishable from the Colubers; their mouth is furnished above with four rows of teeth like the non-venomous serpents without there being perceived, in the place ordinarily occupied by the fangs, any thing of a nature indicative of the existence of a venomous apparatus. In fact, the excretory canal of the poisonous gland, in them, terminates in one of the last maxillary teeth, which is somewhat larger than the others, and simply furrowed by a gutter. Some of the serpents of America and Africa possess this kind of organization.

75. There are also others which, with the armature of the mouth very nearly like the last, have the first maxillary tooth larger than the others, and pierced, like the moveable fangs above mentioned, to conduct the poison. Some, known in India under the name of *Rock Serpents,* have simple plates under the belly and tail, and constitute the genus BUNGARUS. The others, called HYDRUS, have the posterior part of the body and tail very much compressed, and raised vertically, which gives them facility in swimming: they are common in certain parts of the Indian seas.

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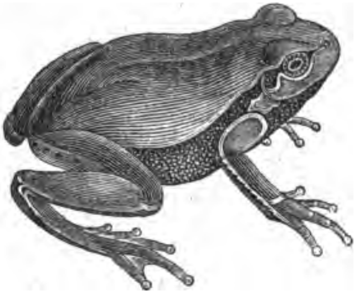
73. What is the genus Elaps? What is the genus Platurus?

74. What are the general characters of Serpents without isolated fangs?

75. What are the characters of the genus Bungarus? What are the characters of the genus Hydrus?

LESSON IV.

ORDER OF BATRACHIA.—*Organization.—Classification.*
FAMILY OF ANOURA.—*Metamorphosis of Tadpoles.—Habits.—Frogs.—Tree-Frogs.—Toads.—Pipa.*
FAMILY OF URODELA.—*Salamanders, or Water-Newts.*
FAMILY OF BRANCHIFERA.—*Axolotl.—Menobranchus.—Proteus. Siren.*
FAMILY OF APODA.—*Cœcilia.*



ORDER OF BATRACHIANS.

1. The name Batrachian, (from the Greek, *Batrachos*, frog,) is given to all reptiles that resemble frogs in their mode of organization. This fourth and last division of the Class of Reptiles, brings us into the neighbourhood of the fishes; for it is composed of animals that, during the early period of their life, respire by branchiæ, and resemble fishes in their habits and form, as well as in their mode of organization, but which, with the advance of age, undergo a true metamorphosis, and acquire characters common to other reptiles. When in this transitory state, they are called *Tadpoles.*

2. The branchiæ of young Batrachians are placed upon the sides of the neck, and are sustained by the lateral prolongations of a cartilage which represents the hyoides. Sometimes they are in the form of external feathery tufts, which float in the water; at others, they consist of filaments fixed along the hyoid branches just mentioned, and covered by the integuments. In proportion as the lungs become developed, in general, the branchiæ wither, and at last entirely disappear; but this is not always the case, and, in some reptiles, they remain throughout life, conjointly with the lungs.

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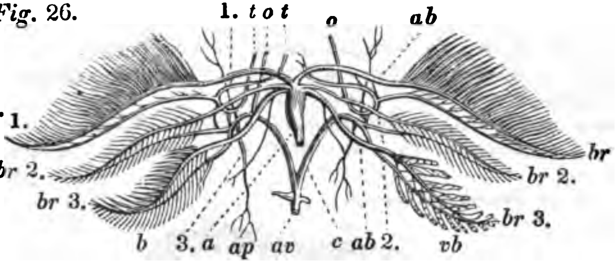
1. What kind of animals form the order of Batrachians? What are Tadpoles?
2. What is the situation of the Branchiæ in young Batrachians? What is their form? Do they always exist throughout the life of the animal?

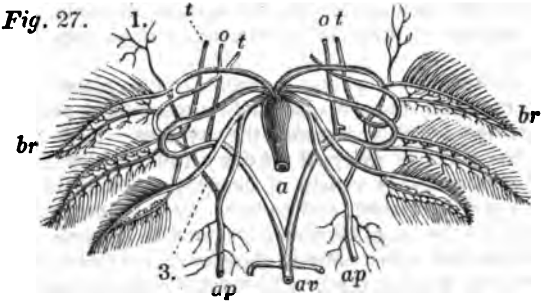
Fig. 26.



CIRCULATION OF A TADPOLE.

Explanation of Fig. 26.—Principal blood vessels of the Tadpole of the Salamander:—*a*. the artery which arises from the only ventricle of the heart; it divides into six branches which go to the three pairs of branchiæ, and there ramify; (they are called *branchial arteries, ab.*;)—*br*. the branchiæ, in which we see the distribution of the branchial arteries, and the origin of the branchial veins, (*vb.*) which receive the blood after it has passed through the lamellæ of the branchiæ; those of the two last pairs of branchiæ unite on each side to form a vessel, (*c.*) which, by uniting with its fellow on the opposite side, forms the ventral aorta or dorsal vessel, (*av.*) which is directed backwards, and distributes the blood to most of the body; the branchial vein of the first pair of branchiæ is bent forwards, and carries the blood towards the head, (*t,t.*);—1. an extremely small anastomosing branch, which unites, the branchial artery and vein, at the base of the first branchiæ, and which, by afterwards becoming larger, permits the blood to pass from the first of these vessels into the second, without passing through the branchiæ;—2. a small anastomosing branch which, in the same manner, establishes a communication, between the artery and vein of the second pair of branchiæ;—3, a vessel, which, by a filament situate further in, also joins together the artery and vein of the posterior branchiæ;—*o*. the orbital artery;—*ap*. the rudimental pulmonary arteries.

Fig. 27.

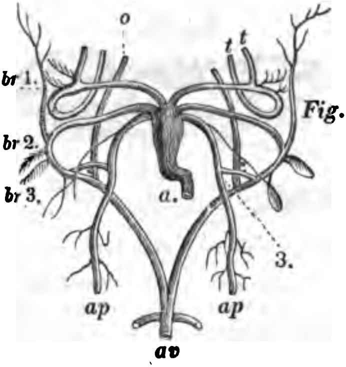


CIRCULATION OF A TADPOLE, IN THE PROGRESS OF METAMORPHOSIS.

Explanation of Fig. 27.—The same parts in a Tadpole in which the branchiæ begin to lose their importance in respiration, and in which a part of the blood goes from the heart to different parts of the body without pass-

3. The apparatus of the circulation undergoes changes corresponding to those experienced by the organs of respiration. The heart of Batrachians, like that of most reptiles, is composed of two auricles and a single ventricle, from which arises a great artery; at its base, this artery is swelled into a contractile bulb, and soon after bifurcates. When the animal breathes by branchiæ alone, the blood, forced by the ventricle, is distributed to these organs, from which the greater part of it, goes to the dorsal artery, the branches of which ramify in the various organs. In fishes this liquid follows the same course. But when the lungs are developed, the disposition of the circulatory apparatus changes: there is established a direct communication between the vessels which carry the blood to the branchiæ, and those that receive it from those organs, so that it is not necessary for this liquid to pass through the respiratory apparatus to reach the dorsal artery, and, through it, the different parts of the body. The artery, *(Fig. 28, a.)* which arises from the ventricle, and which could be compared at first to a branchial artery, then becomes the origin of the dorsal vessel, and with it constitutes a true aorta, certain branches of which, that go to the lungs, are developed at the same time,

Fig. 28*



CIRCULATION IN A PERFECT BATRACHIAN.

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ing through these organs; the same letters indicate the same vessels as in the preceding figure, and it will be observed that the anastomosing branches, (1. 2. 3.) which, in the Tadpole, were capillary, and did not give passage to a very considerable quantity of blood, are here of some size, and that they seem to be continuous with the branchial vessels rather than with the arteries coming from the heart. The pulmonary arteries are also much developed.

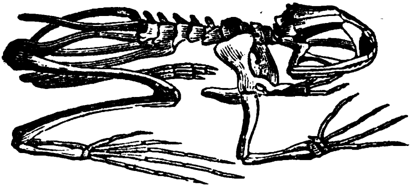
**Explanation of Fig.*28.—The same parts in the perfect animal, indicated by the same letters as in Figs. 26. and 27. Here the vessels of the branchiæ have become rudimentary, and the pulmonary arteries much developed; the vessels which convey the blood to the middle branchiæ are continuous, without interruption, with those (*c.*) that receive this liquid after its passage through these organs, and thus form an aortic cross, on each side of the heart.

3. What are the characters of the heart in Batrachians? What are the peculiarities of the circulation in Batrachians? In what respect does the circulation of Batrachians differ from that of fishes? Does the aorta in Batrachians circulate pure arterial blood?

and establish a pulmonary circulation. Finally, the branchial vessels are obliterated, and then the circulation is carried on nearly in the same manner as it is in other reptiles. The venous blood, returning from all parts of the body, is poured into the ventricle by one of the auricles, and there mixed with the arterial blood, coming from the lungs and poured into the same ventricle, by the other auricle. This mixture enters the aorta; a small portion goes to the lungs, but the largest part is distributed to the different organs of the animal.

4. The skeleton of Batrachians presents remarkable peculiarities; in general, the ribs are entirely wanting, or are merely rudimentary, for which reason pulmonary respiration cannot be carried on by the ordinary mechanism; and in fact, the animal introduces air into its lungs by a species of deglutition. It is to be observed, also, that the skin of these reptiles is not covered with scales like that of Saurians, Ophidians, and most Chelonians, but is naked. Almost all Batrachians are without nails. Their eggs are enveloped only in a gelatinous mass which swells very much in water, and they are not generally fecundated until after they are laid.

Fig. 29.



SKELETON OF A FROG.

5. This order is divided into four families, namely:

1st. The **Anoura**, which, in their perfect state, have no tail, and do not preserve their branchiæ, and are provided with four extremities.

2nd. The **Urodela**, which also lose their branchiæ, and acquire extremities, but preserve the tail.

3rd. The **Branchifera**, which always preserve their branchiæ; they resemble those Urodela in which developement had been arrested while yet in the tadpole state.

4th. The **Apoda**, or **Cæcilia**, which also lose their branchiæ, but never acquire extremities: until lately they were classed amongst the Ophidians, under the name of *Naked Serpents*, or *Nuda*.

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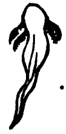
4. What are the peculiarities of the skeleton of Batrachians? What is the character of their skin?

5. How is the order of Batrachia divided? What are the characters of the family of Anoura, when perfect? What are the characters of the family of Urodela when perfect? How is the family of Apoda characterised? What are naked serpents? What are the characters of the family of Branchifera?

FAMILY OF ANOURA.

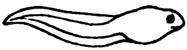
6 This family is composed of frogs, toads, and some other reptiles having nearly the same form. In them the metamorphosis is more complete than in all other animals of this order. When the young tadpole first leaves the egg, it resembles a little fish, and can live only in water. Its head is very large, its belly protuberant, and its body unprovided with extremities, is terminated by a compressed tail, which afterwards becomes elongated, and much raised: its mouth is still a small, scarcely perceptible hole, and its branchiæ consist only of a tubercle placed on each side of the posterior part of the head. These appendages very soon become lengthened, and are divided into shreds, (*Fig.* 30.); the eyes are perceptible through the skin, and a transverse slit appears under the neck, so as to form a sort of membranous operculum. A little later, (*Fig.* 28, *Page.* 67.) the branchiæ become ramified, and the lips are covered by a sort of horny beak, by the aid of which the animal fixes itself to vegetables, that form its chief food; but this state does not last long. At the end of a few days the branchial fringes, which float on each side of the neck, disappear, (*Fig.* 31.) and respiration is carried on by the assistance of small vascular tufts, placed along four cartilaginous arches, situate under the throat, and pertaining to the hyoid bone. A membranous tunic, covered by the skin, envelopes these internal branchiæ, to which the water arrives by the mouth, passing through the intervals of the arches of the hyoid bone; finally, after having laved these organs, this liquid escapes by one or two external slits, the situation of which varies a little according to the species. The respiratory apparatus, then, as we have said above, exactly resembles that of fishes. Sometime afterwards, the posterior extremities of the Tadpole show themselves, and are developed little by little, (*Fig.* 32.); they attain considerable length before the anterior extremities are perceived. The latter are developed beneath the skin, which they penetrate at a later period, (*Fig.* 33.) About the

Fig. 30.



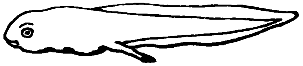
TADPOLE.

Fig. 31.



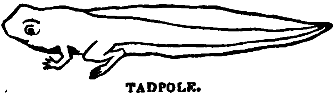
TADPOLE.

Fig. 32.



TADPOLE.

Fig. 33.



TADPOLE.

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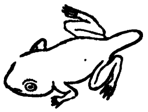
6. What reptiles compose the family of Anoura? What changes do the animals of this family undergo in early life? What is a Tadpole?

Fig. 34.



TADPOLE.

Fig. 35.

FROG.

same time, the horny beak falls off, leaving the jaws unencumbered; the tail begins to waste away, (*Fig.* 34.) the lungs are developed, and, in proportion as these organs become more exclusively the seat of respiration, the branchiæ fade and disappear; the cartilaginous arches which supported them are also in part absorbed; and finally the tail entirely disappears. The little animal assumes the form which it preserves through life, and completely changes its regimen, (*Fig.* 35.) From being at first herbivorous, it gradually becomes exclusively carnivorous, and in proportion as this metamorphosis advances, the intestinal canal, from being long, slender, and spirally folded, becomes short, almost straight and swelled, to form the stomach and colon.

7. The period of these changes varies, from about four to eight weeks, according to the species, and it has been ascertained that different circumstances may considerably hasten or retard, the complete metamorphosis of the young animal. A deficiency of heat and light, very much prolongs the duration of the tadpole state.

8. Having reached their perfect state, the Anoura cease to be aquatic animals; but most of them continue to live in the neighbourhood of water and dive frequently in it. They cannot remain, during the warm season, constantly in the water, even though they come freely to the surface to breathe the air; pulmonary respiration is not then sufficient for them, and they require the action of the air on the skin; in winter, however, this cutaneous respiration is not only sufficient to sustain life, but they can remain several months in the water without coming into the air.

9. All these reptiles have a thick-set body, a flat head, the muzzle more or less rounded, a very wide mouth, short fore feet terminated by four toes, and the hind feet are longer, and sometimes possess the rudiment of a sixth toe. Their eyes are ordinarily furnished with three lids, but sink into the head, on slight pressure; because the orbits are separated from the mouth only by membranes. A cartilaginous plate occupies the place of a tympanum, and causes the ear to show externally. The tongue

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7. Is the time occupied in these changes the same in all species of Anoura? What circumstance influences the time occupied in the metamorphosis?

8. What are the habits of the Anoura? Is respiration carried on exclusively by the lungs?

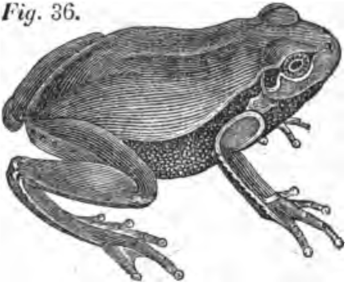
9. What are the general characters of the Anoura? How do they breathe? What is peculiar about the tongne?

is generally soft, and, contrary to what we see in most mammals, it is fixed to the edge of the jaw only by its anterior extremity, so that it can be folded backwards, or turned out of the mouth. Finally, the skeleton of these reptiles (*Fig.* 29, *Page* 58.) is entirely unprovided with ribs, and the inspiration of air can be effected only by a movement analogous to that of deglutition, in which the animal dilates the throat to fill it with air; then, closing the posterior nostrils with the tongue, contracts the muscles of the swallow, and forces this fluid to enter the lungs: to throw one of these animals into a state of asphyxia, it is only necessary to keep the mouth open for a certain time.

10. The Frogs,—*Rana*,—have the body more tapering than the other Anoura; the hind feet are very long, very strong, and more or less palmate, which enables them to swim and leap well. The skin is smooth, and the males have on each side of the neck, beneath the ears, a thin membrane which becomes inflated, when they croak. They are distinguishable from toads by a row of very fine, small teeth, all around the upper jaw. These reptiles ordinarily keep on the banks of ponds and rivulets, and precipitate themselves into the water on the slightest danger: they feed only on living prey, and eat the larva of aquatic insects, worms, small mollusks, and flies. In winter they bury themselves in the mud, or in holes, and do not eat.

11. We give the name of Tree-Frogs,—*Hyla*,—to Batrachians which do not differ much from frogs, except that the extremity of each one of the toes is enlarged, and rounded into a sort of viscous pellet or ball, (*Fig.* 36.) that enables them to adhere to bodies upon which they climb, and to ascend trees. Endowed with great suppleness and agility, Tree-frogs travel very lightly on the most flexible branches. During the whole summer they live, in this manner, on trees, pursuing insects; but in winter they retire to the bottom of the water like frogs, and do not return again to the humid woods in the spring, till after they have deposited their eggs. The common

Fig. 36.



COMMON TREE-FROG.

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10. What are the general characters of Frogs? How are they distinguished from Toads? What are the habits of Frogs?

11. What are Tree-Frogs? What are their habits?

Tree-frog,—*Rana arborea*,—is of an apple green above, and pale beneath, with a black and yellow line along each side of the body.

12. The Toads,—*Bufo*,—have a thick-set body, covered with warts, or papillæ, from which exudes a viscid humor; on each side of the neck there is a large, projecting gland, (called *parotid*,) full of pores, which secretes an acrid humor. Their hind legs are not so much elongated as those of frogs, and they leap badly; in general they creep rather than walk, and, when surprised, instead of taking to flight, they stop suddenly and inflate the body so as to render it hard and elastic, and cause the skin to pour out a white humor; sometimes they endeavour to defend themselves by biting; but their mouth is unprovided with teeth, and their bite is not venomous, as is generally supposed in the country. These hideous and disgusting reptiles ordinarily conceal themselves in shady, humid places, from which they do not go out, except at night, or immediately after the warm and abundant rains of summer. Like frogs, they feed on small mollusks, worms, and living insects, but they are more terrestrial in their habits; they betake themselves, in summer only, to pools and streams, where the females resort to deposit their eggs. In countries where the winter is cold, they pass the season benumbed in holes. Their respiration then becomes extremely limited, and the contact of a very small quantity of air with the skin is sufficient to maintain their existence. When placed in situations where ordinary evaporation is very inconsiderable, they can live in this way for a very long time. This explains how it is that toads, which have been enclosed in plaster, or shut up in holes, excavated in stones, are often found alive, after being many months in confinement.

13. Curious experiments have been made with a view of ascertaining the fact, (which had been often observed, but generally treated as fabulous by naturalists,) of the existence of living toads in walls, in hollow trees, and even in the interior of rocks, where they had probably remained for years, without being able to escape. Labourers who work in quarries have often met similar instances, on breaking blocks of stone, and they pretend that the toad is found enclosed in the stone on all sides, as in a solid mould, which would lead us to suppose that it had formed around the body, and that the seclusion of the reptile dated from a very remote antiquity; but this opinion is inadmissible, and every

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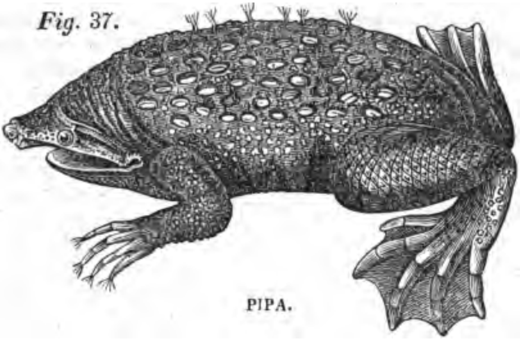
12. What are the characters of Toads? How are they distinguished from Frogs? What are their habits?

13. How is it that Toads are enabled to exist, excluded from the atmospheric air, shut up in rocks, hollow trees, &c.?

thing leads us to believe, that in such cases, the retreat of the toad communicates externally by some hole which had been accidentally closed, or had escaped observation.

14. The Pipas are still more hideous than the toads: their body is more flattened, the head triangular, their eyes very small, their hind legs short, and their anterior toes split at the end into three or four small points; the tongue is entirely wanting. The species best known, which inhabits the warm and humid parts of South America, is celebrated on account of the manner in which its young are developed. The male places the eggs on the back of the female, who immediately takes to the water, where the skin, irritated by the contact of these bodies, swells, and forms cells, in which the young are hatched, and remain until they have completed their metamorphosis; then the mother returns to land.

Fig. 37.



PIPA.

FAMILY OF URODELA.

15. The metamorphosis of Batrachians of this family is less complete; for, in the perfect state, they still preserve the long tail, which, in the preceding family, only exists in the tadpole. At the time of escaping from the egg, they are without feet, and respire by branchiæ, which are in the form of tufts, and three in number; they are placed on each side of the neck, and float externally. As in the Anoura, their extremities appear successively, but the fore feet make their appearance before the posterior; and, to complete the transformation of the tadpole, the lungs are developed, and the branchiæ disappear. In the adult state, these animals have nearly the same form as lizards; but their head is flattened, and we do not perceive the tympanum

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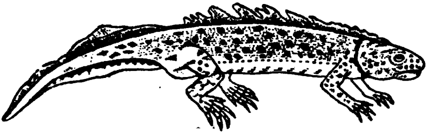
14. What are the characters of Pipas ?
15. What are the characters of the family of Urodela ?

externally. Both jaws, and the palate are armed with small teeth; their tongue is placed as it is in frogs; the skeleton has rudimentary ribs; and the number of their toes is four in front, and almost always five behind. Some authors designate these animals under the name of *Salamanders.*

16. TRITONS, or Aquatic Salamanders, are the most common batrachians of the family of Urodela; they always preserve a laterally compressed tail, (*Fig.* 38.) and pass nearly all their time in the water. The most remarkable faculty possessed by these reptiles, is the astonishing facility, with which they repair any mutilation to which they may be subjected. They not only replace the tail after it has been cut off, as is the case also with lizards, but their extremities are reproduced in the same manner. The same extremity, after having been cut off, has been reproduced entire with its bones, its muscles, its vessels and nerves, several times in succession, and we are even assured that, in one experiment, the eye, after having been extirpated, was reproduced in the space of a year.

Fig. 38.



CRESTED SALAMANDER, OR TRITON.

17. Several species are found in the neighbourhood of Paris. Sometimes the tadpoles become very large before losing their branchiæ. A fossil, found in the schists of Œningen, and belonging to a large species of Salamander, has excited a good deal of interest; because, from a singular error, it was for a long time regarded as the skeleton of a fossil man.

18. SALAMANDERS PROPERLY SO CALLED, or TERRESTRIAL SALAMANDERS in the perfect state, have a round tail, and only remain in the water during their tadpole existence, or when they lay. Their eggs are hatched before they are laid, and the young at first have a compressed tail like ordinary tadpoles; they lose the tail, and finish their metamorphosis very promptly. In the perfect state, they inhabit shady, humid situations: they are ordinarily found under stones, or in subterraneous holes. It was for a long time believed that Salamanders had the power of resisting the action of fire; but this fable was without foundation; except, perhaps, that when the reptile is irritated, it sweats a milky

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16. What are Tritons? For what are they remarkable?
17. What led to the belief that a fossil man had been discovered?
18. What are Salamanders properly so called? How are they distinguished from Tritons?

humor. This humor appears to be poisonous to feeble animals; but the Salamander is not, as is supposed among certain country people, an injurious animal.

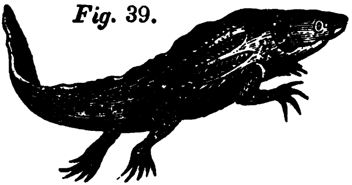
19. There has been discovered in America, a large batrachian, of the precise form of the Salamander, that has an orifice on each side of the neck, but which, it is supposed, never has branchiæ. It is probable, however, that these organs do exist in the first periods of life, but disappear at an early date, as is the case in the terrestrial Salamander. These reptiles, which form the genus MENOPOMA, inhabit the great lakes and rivers in the interior of South America, The AMPHIUMA, which inhabit the same continent, possess the same mode of organization; but their body is excessively elongated, and their extremities are but little developed. The number of their toes varies from two to three, according to the species.

FAMILY OF BRANCHIFERA.

20. This family is composed of batrachians that always preserve their branchiæ, and resemble the tadpoles of batrachians of the family of Urodela; they have been regarded for a long time as being in fact, the young of some large species of Salamander; but now, there is no doubt of their being perfect animals, and what is very remarkable, that possessing well developed branchiæ, they also have lungs, and are consequently completely amphibious. These branchiæ, which are placed in the ordinary situation, have the form of tufts more or less ramified, and float externally in the water. The lungs are sometimes provided with a vascular net work as well developed as in any reptile, while in others, their structure is very simple. The body of these animals terminates in a long, vertical tail; and their extremities are but little developed, and often are partly wanting. Four genera are known, namely; the *Axolotus*, the *Menobranchus*, the *Proteus*, and the *Siren*.

21. The AXOLOTLS,—*Axolotus*,—in every respect resemble the tadpoles of Salamanders, that have acquired their fore paws. Only a single species has yet been discovered, the *Axolotl* of the Mexicans,—*Siren pisciformis*, (*Fig.* 39.) which inhabits the lake in the midst of which stands the city of Mexico.

Fig. 39.



AXOLOTL.

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19. What are Monopoma? What are Amphiuma?

20. What are Branchifera? What are their general characters? What are the genera of this family?

21. What are the characters of the Axolotls?

Fig. 40.

PROTEUS.

22. The Menobranchus, also have four feet; but instead of having four toes before, and five behind, they have only four throughout.

23. The Proteans,—*Proteus*,—have but three toes in front and two behind. The only species known,—*Proteus anguinus*,—(*Fig.* 40.) more than a foot long, and only as thick as the finger, is found in the subterraneous waters of some of the caverns of Carniole. Its skin is smooth and whitish, its muzzle is elongated and depressed, and its eyes are exceedingly small, and concealed beneath the integuments.

24. The Sirens, have anterior extremities only, and, in the elongated form of their body, resemble eels. Three species are known, one of which attains three feet in length, and inhabits the marshes of Carolina.

FAMILY OF APODA.

25. The Apoda, or Cæcilia, as we have already stated, are entirely without extremities, and, until lately, have been regarded as Serpents; but it has been ascertained that, in early life, they have branchiæ which show themselves through a hole on each side of the neck. In the adult animal we find even the arches of the hyoid bone, which served to sustain these organs. The body is very nearly cylindrical. The skin is smooth and transversely furrowed by annular wrinkles. At first sight, it appears to be entirely naked; but on dissection, we find in its thickness rows of small and extremely thin scales, situate in these wrinkles. The eyes which are very small, are concealed beneath the common integuments, and sometimes they are entirely wanting. These animals are completely apodous, that is, without feet, and their skeleton, like that of serpents, has two long rows of ribs; but these bones are much too short to surround the trunk, and, on the other hand, we remark, in the mode of articulation of the vertebræ, and in the disposition of their jaws, many characters which approximate them to the latter batrachians.

26. These reptiles, which establish a passage between the batrachians and Ophidians, inhabit humid and shady places, dig holes in the ground, and seem to feed on vegetable substances as well as on worms and small insects. They are found in South America.

The Class of Fishes comes next in order.

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22. What are the characters of Batrachians of the genus Menobranchus?
23. What are the general characters of the Proteans?
24. What are Sirens?
25. What are the general characters of the Apoda?
26. Where are they found? What are their habits?

ICHTHYOLOGY.

LESSON V.

CLASS OF FISHES.—*General Characters.—Form.—Integuments.—Skeleton. — Muscular Apparatus. — Swimming-Bladder. — Senses.—Apparatus of Digestion. — Circulation. — Respiration.—Animal Electricity.—Habits—Fishing—Classification.*

CLASS OF FISHES.

The fourth, and last Class of the Branch of Vertebrate Animals, comprises the Fishes: that part of Natural History which treats of them, is termed Ichthyology, from the Greek, *ichthus*, a fish, and *logos*, a discourse.

1. These animals, as every body knows, are destined to live under water, and this circumstance has impressed upon them a peculiar organization; but the most important differences they present, when compared with other vertebrata, consist in the conformation of the apparatuses of respiration and circulation. They never have lungs, and always breathe by branchiæ only. Their heart has but two cavities, and only receives venous blood, which, after being in contact with oxygen, enters a dorsal vessel, where no new motive force accelerates its course to different parts of the body. Therefore, their circulation is not as active as it is in the superior animals, and like that of reptiles, their blood is cold. Their skin is naked, or covered with scales only; they have no mammæ like the mammalia, and are reproduced by the means of eggs; their extremities are in the form of fins.

2. The external form of fishes varies; but their body is generally all of a piece. The head, which is of the same size of the trunk, is not separated from it by a narrowing like the neck of the superior vertebrate animals, and the tail, owing to its size at the base, is not distinguishable from the rest of the body. Some of these animals are entirely without fins; but in most of them we find a considerable number of these organs, some placed on the middle line of the back or belly, and consequently unpaired or singly, and others on the side, arranged in pairs. The latter

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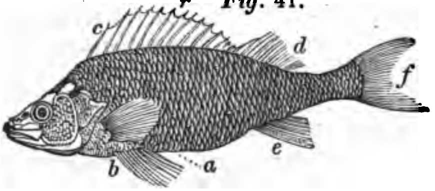
1. What are the general characters of Fishes? What is the peculiarity of their respiration? How does their heart differ from that of mammals?

2. What is the general form of Fishes? What is the situation of the pectoral fins? Where are the ventral fins placed? What are dorsal fins? What is the situation of the anal fin? What are the caudal fins?

represent the extremities of other vertebrate animals, the anterior extremities which correspond to the arm in man, and the wing in birds, are fixed on each side of the trunk, immediately behind the head, and are called *pectoral fins*, (*Fig.* 41, *a.*) The abdominal extremities (*b.*) less distant from each other, generally occupy the inferior face of the body, and may be placed more forward or backward, from beneath the throat to the origin of the tail: they are called *ventral fins.* The single or unpaired fins occupy, as we have just said, the middle line of the body, and are distinguished into *first dorsal,* (c.) *second dorsal,* (*d.*) *anal,* (*e.*) and *caudal fins,* (*f.*) according to their situation on the back, under the tail, or at its extremity. They are all nearly of the same structure, and almost always consist of a fold of the skin, sustained by bony or cartilaginous rays, very much in the same manner that the wings of bats and dragons are sustained by the fingers or toes, or by the ribs of those animals.

Fig. 41.*



PERCH.

3. We also observe on the external surface of the body, large slits placed, on each side, immediately behind the head, which serve as an outlet to the water which has laved the branchiæ: they are openings of the gills. Generally, there is but one on each side, and their anterior edge is moveable, and resembles a shutter. Along the whole length of the body, on each side, there is a series of pores which form what ichthyologists call the *lateral line.*

4, The skin is sometimes nearly naked, but is almost always covered with scales. Sometimes these scales are in the form of rough grains; sometimes they are very stout tubercles, or plates of considerable thickness; but, in general, they are very thin lamellæ, covering each other like shingles or tiles, and let into folds of the skin. They may be compared to our nails; though they contain more calcareous salts. The colours with which these animals are adorned, are astonishing in their variety and brilliancy. Sometimes they can only be compared to the most glitter-

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* *Explanation of Fig.* 41.—A common Perch,—*a.* the pectoral fin of one side,—*b.* ventral fin,—*c.* first dorsal fin,—*d.* second dorsal fin,—*e.* anal fin,—*f.* caudal fins.

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3. What are the gill openings? What is their use? What is meant by the lateral line?

4. What is the character of the skin? What is the nature of scales? How do they obtain their colour?

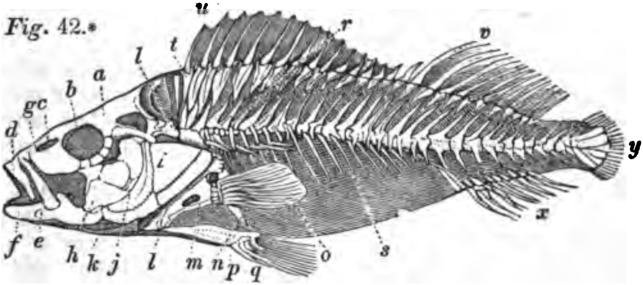
ing gold or silver; sometimes they present the richest tints of green, blue, red, or black. The silvery matter which frequently gives them such a beautiful metallic lustre, is secreted by the skin, and is composed of a multitude of small polished plates.

5. The skeleton of fishes is ordinarily bony; but in many of these animals, it always remains fibro-cartilaginous, or cartilaginous, and in some, this frame possesses even less solidity and remains absolutely membranous. In this respect, they form the connecting link or passage between the vertebrate and invertebrate animals.

6. The bones never have a medullary canal, and the cartilage which constitutes their basis is not like that of mammals and birds; for, when boiled in water, it does not yield gelatine.

7. The skeleton is composed of a head, to which is joined a highly developed hyoid apparatus, serving for respiration; a trunk and extremities.

Fig. 42.*



SKELETON OF A PERCH.

8. The structure of the head is very complicated: we first observe a middle portion, composed of a great number of bones joined together by sutures, and forming a sort of immoveable keel to which are suspended the bones of the jaws, cheeks, &c. This

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**Explanation of Fig.* 42.—Skeleton of a Perch:—*a.* the skull,—*b.* the orbit,—*c.* the nostrils,—*d.* the intermaxillary bone,—*e.* the maxillary bones,—*f.* the lower jaw,—*g.* the sub-orbital bone,—*h.* the tympanic bone, and the other bony pieces which separate the mouth from the cheeks, and support the lower jaw,—*i.* the operculum,—*j.* the ante-operculum bone,—*l.* the scapula, or shoulder blade,—*m.* the bones of the arm,—*n.* the coracoid bone,—*o.* the pectoral fin,—*p.* the pelvis,—*q.* the ventral fin,—*r.* the vertebræ,—*s.* the ribs,—*t.* the interspinal bones,—*u.* the bony spine of the first dorsal fin,—*v.* the cartilaginous spine of the second dorsal fin,—*x.* the anal fin,—*y.* the caudal fin.

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5. What is the nature of the skeleton of fishes?

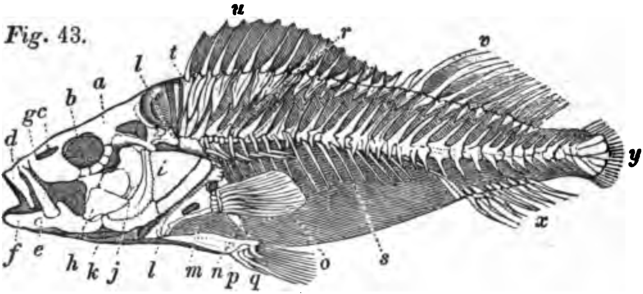
6 What is the character of the bones of fishes? How does fish-bone differ from that of mammals?

7. How is the skeleton of fishes divided?

8. What are the general characters of the head?

middle portion. the form of which is that of a pyramid with three sides, with its summit directed forward, presents posteriorly the cranial box, or skull, (*Fig.* 42, *a.*) in which is lodged the apparatus of hearing as well as the brain. Its middle part is hollowed out to form the orbits, (*b.*) and in front, we find pits which belong to the olfactory apparatus, (*c.*) There are bones which correspond to those of the heads of mammals, but most of these bones, in fishes, are composed of several pieces, which never run together into one, as happens at an early age in the mammalia and birds.

Fig. 43.



SKELETON OF A PERCH.

9. At the anterior extremity of this portion of the head, we find the upper jaw, which is sometimes immoveable, though it generally preserves great mobility: on each side there is an inter-maxillary bone, (*d.*) placed near the middle line, and a lower jaw bone which extends laterally, and moves upon the first. Besides these parts, we find a very considerable apparatus designed to afford attachment to the branchiæ, or to protect them, composed in part of the hyoid bone, which is covered on each side by a sort of cover or door, called *operculum*, (*i.*) or gill-cover.

10. The vertebral column, (*r.*) which is continuous with the head, is divided into two distinct portions, one dorsal, and the other caudal. The body of the vertebræ has a peculiar form; it is hollowed before and behind by a conical cavity; these two hollow spaces are sometimes joined so as to form a hole, and the double conical cavity arising from the junction of two neighbouring vertebræ, is filled by a soft substance. The ring, destined to form a passage for the spinal marrow, is surmounted by a spinous process, and on each side there is a more or less distinct transverse process, which, over the cavity of the abdomen, extends outwardly, and articulates with the corresponding rib, but in the

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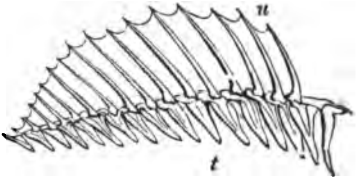
9. Is the upper jaw moveable or not? What is the operculum?
10. What are the characters of the vertebræ in fishes?

caudal portion of the spine, it is directed downwards, and often forms, with its fellow of the opposite side, a ring, from the lower part of which arises a long spinous process, similar to that which is situate on the dorsal face of the vertebra.

11. The ribs are sometimes wanting; at other times, they encircle the whole abdomen, and, in a small number of fishes, they are fixed to a series of unpaired or single bones, which should be regarded as the sternum. They frequently sustain one or two stylets which have an outward direction, and penetrate the flesh. Sometimes there are similar stylets arising from the bodies of the vertebræ, and hence it is that, in certain genera, such as herrings, fish-bones become so numerous.

12. On the middle line of the body, we also find a certain number of bones, called *interspinal*, *(Fig. 43, t.)* which generally rest upon the ends of the spinous processes of the vertebræ, and, by their opposite extremities, articulate with the rays of the middle fins, (*u.*) These rays are sometimes pointed bones, called *stings*, or *spines;* sometimes they are stalks or stems bony only at the base, formed of a multitude of small articulations in continuation, and often branched towards the end. These last appendages are called *soft*, or *articulated* rays: they always form the caudal fin, and sometimes there are no others.

Fig. 44.



INTERSPINAL BONES.

13. The lateral fins, which represent the extremities, are terminated by rays similar to those of the vertical fins, and analogous to fingers. At the base of the pectoral fin we find a series of from four to five small flat bones, comparable to the bones of the carpus, which, in their turn, are attached to two flat bones which seem to be the radius and ulna enlarged. This apparatus is supported on a species of bony belt, situate immediately behind the gills, and on which the operculum applies: it consists of a series of three bones, extending from the cranium to the hyoid apparatus, and supports posteriorly a long stylet. The principal piece that enters into its composition is that which supports the fore-arm, which may be compared to the humerus, (*See Fig.* 42, *Page* 80.): it joins below with that of the opposite

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11. What are the characters of the ribs?
12. What are the interspinal bones? What are the rays of the fins?
13. What parts of fishes represent the extremities of mammals?

side, and with a middle prolongation of the hyoid apparatus, and is attached to the cranium through the medium of two bones, which Cuvier considers analogous to the scapula; finally, the stylet which arises from it, and is prolonged backwards upon the ribs, is ordinarily formed of two pieces, and may be compared to a coracoid bone.

14. The posterior extremity is less complicated; the rays of the ventral fin are supported by a single bone, generally triangular, which often becomes attached in front, to the middle junction of the bony belt of the pectoral extremity, and at other times it is merely suspended in the flesh.

15. In cartilaginous fishes, the arrangement of the skeleton differs from what has just been described. The head especially, is much more simple in its structure.

16. The muscular apparatus is composed of muscles destined to flex the vertebral column laterally, and also to move the tail; they form the largest part of the mass of the body of fishes. By striking the water laterally, by alternate flexions of the trunk and tail, these animals communicate to their body, nearly the whole of the rapidity they have in swimming. Their vertical fins serve to increase the extent of the species of keel or oar they form, while the chief use of the pectoral and ventral fins, in general, is to influence the direction of their course, and to maintain the equilibrium of the animal.

17. A peculiarity of their organization, which is of great assistance in swimming, is the existence of a sort of pouch filled with air, and so placed that it can be compressed at will. This *swimming*, or *air-bladder*, which is placed in the abdomen beneath the dorsal spine, ordinarily communicates with the œsophagus, or stomach, by a canal, through which the air contained in it, may escape; but this fluid does not seem to enter by that route; it is produced by secretion, the seat of which is in a portion of the parietes of the reservoir itself, which is of a glandular structure. By the motions of the ribs, this bladder is more or less compressed, and, according to its volume, it gives to the body of the fish, a specific gravity, equal, superior or inferior to that of the water, and causes it thus to remain in equilibrium, to descend, or ascend in this liquid. It is remarked that it is often wanting, and that it is very small in those species that swim near the bottom, or bury themselves in the mud.

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14. What is the character of the posterior extremity?

15. Is the skeleton the same in all fishes?

16. By what means do fishes move? What is the use of the fins?

17. What is the air-bladder in fishes? What is the source of the air contained in it?

18. In a small number of fishes, the pectoral fins are so very much developed, as to enable the animal to sustain itself in the air for a few moments, when it springs out of water. There are some also, that by crawling, or by frequent leaps, are capable of progression on land. It is asserted that some can climb trees; but instances of this kind, are very rare.

19. Fishes pass their lives almost entirely in providing for their subsistence, or in escaping from their enemies; their external senses seem to afford them only very dull impressions, and their faculties are of the most limited character.

20. Fishes are very stupid animals; they have no remarkable intelligence or instinct, and their brain, *(Fig. 45, t.)* is but little developed; it does not entirely fill the cavity of the cranium, and is surrounded by a liquid matter of a fatty nature.

21. The ear of fishes, in general, is composed only of a vestibule, surmounted by three membranous semi-circular canals, suspended in the cavity of the cranium, on each side of the brain, and to which waves of sound are communicated, only after they have set in vibration the common integuments and bones of the cranium Generally, there is no appearance of an external ear. Their eyes are ordinarily very large, and are unprovided with true eye lids, and a lachrymal apparatus; the skin which covers them is transparent; and the iris is silvery and immoveable, or nearly so, and the cornea is almost flat, the pupil is very large, and the chrystalline lens is spherical. The nasal fossæ do not open into the pharynx, as is the case in vertebrate animals that breathe air. The tongue is never truly fleshy, and the sense of taste is but little developed. Tact must be extremely obtuse. In general, the skin of these animals is entirely covered with scales; sometimes, however, it is naked.

22. Ordinarily fishes are very voracious, and are not very particular in their choice of food. The species which live chiefly on vegetables, are very few in number; they are almost all carnivorous, and devour each other.

23. Fishes sometimes have teeth, not only in the jaws, but also in all the bones that surround the cavity of the mouth, and that of the pharynx; at other times they are entirely wanting. These teeth never have roots, and their form varies very much, particu-

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18. Are fishes capable of progression, when out of water ?

19. Are the senses of fishes very acute?

20. What is the character of the brain in fishes ?

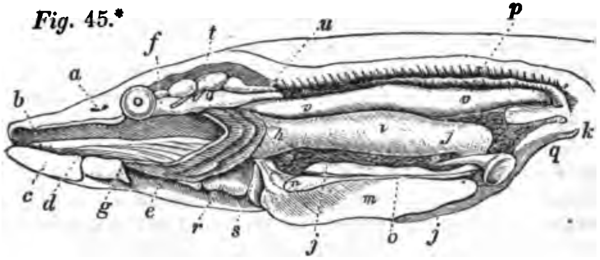
21. What is the character of the ear in fishes ? What are the peculiarities of the eye ? What are the peculiarities of the nasal fossæ ?

22. Upon what do fishes generally feed ?

23. What is the character of the teeth of fishes ?

larly those that are found on the pharyngeal bones, and which serve to grind the food when on its way to the œsophagus. They have no true salivary glands; the œsophagus is very short.

Fig. 45.*



ANATOMY OF A PIKE.

24. The other viscera of the digestive apparatus, (*Fig.* 45.) are lodged in the abdomen, which is lined by a peritoneum, and separated from the cavity containing the heart by a sort of diaphragm, (*s.*) In some fishes, (chiefly the cartilaginous fishes,) the abdomen communicates externally by two openings, situate upon the sides of the anus, so that the peritoneum is continuous with the skin.

25. The stomach, (*i.*) is in general, very distinct; that part which corresponds to the large intestine, is not much larger than the small intestine; and there never is a cœcum as in mammals. The liver, (*m.*) is generally large, and of a soft texture; the position and size of the gall-bladder, (*n.*) vary; the place of the pancreas is almost always supplied by two tubes of a peculiar tissue, placed around the pylorus; the position of the anus varies much; sometimes it is found under the throat, and at others, at the base of the tail. The kidneys, (*p.*) are very voluminous, and extend along both sides of the vertebral column, the whole length of the abdomen. Their excretory ducts terminate in a sort of bladder, the opening of which is posterior to the anus.

**Explanation of Fig.* 45.—Anatomy of the viscera of a Pike:—*a.* the nostrils,—*b.* the cavity of the mouth,—*c.* a part of the lower jaw,—*d.* the tongue,—*e.* the branchiæ, or gills,—*f.* the arch of the palate, or roof of the mouth,—*g.* openings through which the water passes from the mouth to the branchiæ.—*h.* the œsophagus,—*i.* the stomach,—*j.* the intestine,—*k.* the anus,—*m.* the liver,—*n.* the gall-bladder,—*o.* the duct of the gall-bladder, —*p.* the kidneys,—*q.* the urinary bladder,—*r.* the heart,—*s.* the diaphragm, *t.* the brain,—*u.* the spinal marrow,—*v.* the swimming-bladder or air-vessel.

24 Where are the chief organs of digestion situate?

25. What are the general characters of the digestive organs?

26. Digestion seems to be carried on very rapidly, and the chyle is absorbed by numerous lymphatic vessels, which empty, by many trunks, into the venous system, near the heart.

27. The blood of fishes is red; the globules are elliptical in form, and of considerable size.

28. The heart (*Fig.* 45, *r.*) is placed under the throat, in a cavity, separated from the abdomen by a sort of diaphragm, (*s.*) (as we have just said,) and protected by the pharyngeal bones above, by the arches of the branchiæ on the sides, and generally by the humeral cincture behind. It is composed of an auricle, which receives the venous blood collected in a large sinus (a kind of large vein) situated near it, and of a ventricle placed below, and giving origin, at its anterior extremity, to a pulmonary artery, the base of which is inflated, and constitutes a contractile bulb. This vessel soon divides into lateral branches, which are distributed to the gills, and the blood, after traversing these organs, goes to the head through another vessel, which also runs along the arches of the branchiæ. There these canals send some branches to the neighbouring parts, and unite to form a great dorsal artery, which is directed backwards, beneath the spinal column, and sends branches to all other parts of the body. But all the venous blood does not go directly into the sinus mentioned above; that of the intestines, and some other parts, before returning to the heart, is carried through the liver by the *vena porta.*

29. We see now that the blood, in passing through the circulatory circle, entirely traverses the respiratory apparatus as in mammals and birds, but it *only passes once through the heart,* which must render its progress slower. The heart itself corresponds in its functions to the right half of the same organ in the superior vertebrate animals.

30. Respiration is effected by means of the air which is always found dissolved in the water, and takes place on the surface of a multitude of very vascular and projecting lamellæ, attached to the external edge of the branchial arches. Generally, there are, on each side, four branchiæ each composed of two rows of elongated lamellæ. In most of the cartilaginous fishes there are five, and, in the lamprey, we find seven. In almost all the bony

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26. Is the digestion of fishes very rapid?

27. What is the character of the blood in fishes?

28. What is the situation of the heart? What are the peculiarities of the circulatory apparatus in fishes?

29. In what particulars does the circulation of fishes differ from that of mammals and birds?

30. How is respiration effected in fishes?

fishes, these lamellæ are simple, and only attached at their base; in a small number, they are, on the contrary, ramified, and in the form of tufts; finally, in most cartilaginous fishes, they are attached to the skin by their external edge, as well as to the arches of the branchiæ by their internal edge.

31. The water necessary for respiration enters the mouth, and, by an act of swallowing, passes through the slits, left between the branchial curves or arches, and in this way reaches the branchiæ, laves their surfaces, and then escapes through the openings of the gills. We see, in fact, the animal open its mouth, and elevate the operculum alternately. In fishes, in which the branchiæ are free on their external edge, one of these openings on each side is sufficient; but, when the branchiæ are fixed, there is required as many openings as there are spaces betwixt the branchiæ. Consequently, we are made acquainted with the arrangement of the respiratory apparatus by simply inspecting the external openings.

32. Fishes consume a very moderate quantity of oxygen, some however, are not content with what is dissolved in the water, and visit the surface, from time to time, to breathe the air. There are some indeed that swallow it, and by causing it to pass through the intestine, convert the oxygen into carbonic acid. When fishes remain out of water, they generally perish very quickly from asphyxia, not for the want of oxygen, but because, the branchial lamellæ, being unsustained by the water, are effaced, and do not permit the blood to pass readily through them, and because these organs, by drying, become unfitted for performing their functions: therefore, those fishes that perish most promptly from exposure to the air, have widely open gills, which facilitates evaporation from the branchiæ, while those that resist this exposure best, have these openings very narrow, or even possess some receptacle in which they preserve water for moistening these organs.

33. As we have already stated, fishes produce scarcely any heat: but some of them possess the singular faculty of producing electricity, and of giving very powerful shocks to animals that touch them. The Torpedo, the Silurus, and a species of Gymnotus, are of this kind, and what is very remarkable, the conformation of the electric organ differs in each one of them.

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31. How do the gills receive the supply of water necessary for the respiration of fishes?

32. Do fishes require a large quantity of oxygen for the purposes of respiration? Why do fishes quickly die when out of the water?

33. Do fishes produce much animal heat? Do all fishes possess the faculty of producing electricity?

34. To the simultaneous developement of an incalculable number of eggs, deposited in the same place, and the instinct that induces different fishes to follow each other, we must attribute the assemblage of certain species, in immense and close legions, called by fishermen, *shoals of fish.* In fact, we cannot well term these assemblages, companies or societies; the individuals composing them do not aid each other; from having the same necessities to satisfy, they keep in the same locality, or abandon it, and if we sometimes observe one among them followed as a leader, it probably arises from a tendency to imitation which always accompanies the first dawnings of reason.

[It may be astonishing to some to speak of the reasoning of a fish, an animal that is proverbial for its stupidity; but if we study the habits of these beings in our fish-ponds, we shall see that, when they swim tranquilly; without any determined aim, they pass side by side, without seeming to pay attention to the motions of their companions; but, if one of them suddenly perceiving a bait, hastens its course, and swims swiftly in a determined direction, we frequently observe that the other fishes, even those that are placed so as not to perceive the object of attraction, at once follow in the crowd to profit by the discovery. Now, this instinct of imitation resembles simple reasoning, it is true, but consecutive. May we not suppose that these animals attribute the rapid course of their companion to some circumstance of a nature to interest them also, to the discovery of some danger they ought to avoid, or to some bait he rushes to devour, and it is for this reason they hasten in pursuit? And is not this the case every where, even among men; and is not the instinct of imitation, which produces so many good and evil actions, a consequence of this tendency to profit by the results of the observation or judgment of another, and to attribute to the actions of those who seem to be moved by a powerful impulse, an object that it would be equally desirable for all to attain?]

35. Whatever it may be, these animals thus assembled in troops, often make long voyages, either to gain the open sea, or to ascend rivers, or to change their latitude. Certain fishes lead an almost sedentary life, and always remain in the same locality where they were born; others are always roaming, and a great many of these animals make periodical voyages of greater or less extent. In the cold season, they ordinarily approach the coast, or enter rivers, and in this way make long passages. Every year, about the same period, shoals of migratory fishes arrive in the same places, and it is generally believed that many of these species regularly migrate from the north towards the south, and from the south towards the north, pursuing a deter-

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34 How do you account for those vast assemblages of various kinds of fish, termed Shoals?

35. Are the habits of all kinds of fish the same? Are the same fishes always found in the same localities?

mined route; perhaps it would be more correct to believe that when they disappear from the shore, they only retire to the great depths of the sea.

36. According to their habits, fishes are divided into marine and fluviatile; there are some too, that alternately frequent salt and fresh water, and the nature of this fluid seems to exercise less influence upon them than is generally believed; for some essentially marine fishes, have been successfully reared in reservoirs of fresh water.

The number of these animals is immense, and, as they furnish man a wholesome and agreeable aliment, fishing is an important branch of industry among the most savage as well as among the most civilized people.

The Romans, who, after the loss of their liberty, displayed such boundless luxury in the table, did not confine themselves to sending fishing vessels to the neighbouring seas, and to receiving fishes from the Ionians, inventors of the fish-car, which is a kind of floating reservoir for keeping fish alive; but better to secure the supply, the wealthiest citizens constructed immense fish-ponds, filled with sea-water, in which they deposited the most delicate fishes of Sicily, and even of Greece and Egypt. The first person who built one of these great depots was Lucius Muræna, so named, from the care he took of the Muræna or eels: he had numerous imitators, and was even surpassed in his follies by Lucullus, who cut through a mountain near Naples, to introduce the sea-water into his ponds, and hollowed the rocks, which surrounded them, into caverns, to afford his fishes a cool retreat during the heat of summer. Other great personages of the ancient capital of the world, prided themselves on possessing fishes so tame as to suffer themselves to be touched; we are assured, that Crassus was more distressed upon losing one of his eels, than upon the death of his three children; and history relates the curious circumstance of a Roman lady going into mourning on account of the death of a favourite Muræna: to give an idea of this strange taste of those degenerate Romans for fish of every kind, we will mention a supper given to the Emperor Otho by his brother, at which there were served two thousand plates of rare fishes.

"Pliny relates, as a fact, that one Vedius Pollio, a particular friend of Augustus, took delight in throwing his slaves in the eel-vats, for the pleasure of seeing them torn to pieces and

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36. What is the division of fishes according to their habits? Does the quality of the water whether salt or fresh, exercise much influence upon fishes?

devoured. On a particular occasion, the Emperor honoured Pollio with his company, at a brilliant entertainment, at which a slave unfortunately happened to break a costly crystal vase. The unfeeling master, in a paroxysm of fury, exclaimed to the other attendants,—"Away with him to the Murænæ." The poor wretch, almost dead with horror, fell at the feet of the Emperor, beseeching that he might be permitted to die some death less terrible! Astonished at the sudden and strange circumstance, Augustus made speedy inquiry into this extraordinary mode of punishment, and when he fully understood the savage cruelty, disposition, and practice of Pollio, ordered at once, all the remaining vessels broken before his face:—directed the reservoirs to be filled up,—gave freedom to the pleading slave, and only consented to spare the life of the murderer, his master, in consideration of his former regard."—*Natural History of the Fishes of Massachusetts, by Jerome V. C. Smith, M. D.*

Modern times have not witnessed similar follies; but nevertheless, for many maritime people, fishing has not been the less a source of great wealth. At one period, which is not very remote from our own, this branch of industry employed one fifth of the total population of Holland, and in the herring fishery alone, that country covered the whole North Sea with her vessels. In England, it subsisted a considerable number of good and hardy sailors, and even in France, where it is of less importance, there are from thirty to forty thousand fishermen, about one third of whom venture as far as the coasts of Iceland and Newfoundland. And in the United States a very large number of people derive their living from the various fisheries.

37. The immense Class of Fishes is naturally divided into two series, the Osseous and Cartilaginous fishes, which differ from each other, not only in their skeleton, but also in a great number of other characters The modification of the structure of the branchiæ, the disposition of the mouth, and the nature of the fin-rays that sustain the dorsal fin, as well as the position of the ventral fins, furnish naturalists with the basis for the division of the two groups into orders, as may be seen in the following table:

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37. What is the first division of the Class of Fishes? What parts of these animals afford the means or basis of classifying them?

							ORDERS.	EXAMPLES.
CLASS OF FISHES.	*Division of osseous fishes.* Skeleton bony, upper jaw complete.	Upper jaw moveable.	Branchiæ in the form of a comb.	Fin-rays bony in the anterior dorsal fin; sometimes the fin-rays of the anal fin are bony, and ordinarily there is one bony fin-ray in each ventral fin.			*Acanthopterygii.*	Perch, Mackerel, Tunny, &c.
				All the fin-rays soft, except sometimes the first one in the dorsal or pectoral fin. (Malacopterygians.)	With ventral fins,	situate behind the abdomen.	*Malacopterygii Abdominales.*	Carp, Herring, Pike, Salmon.
						suspended to the apparatus of the shoulder.	*Malacopterygii Subbrachiati.*	Cod, Plaice, Turbot, &c.
					Without ventral fins.		*Malacopterygii Apodes.*	Eels, &c.
			Branchiæ arranged in round tufts.				*Lophobranchii.*	Sea-horse, &c.
		Upper jaw solidly fixed to the cranium.					*Plectognathi.*	Ostracion, &c.
	Division of Chondropterygii. Skeleton cartilaginous. Palatine bones in place of bones of the upper jaw.	Branchiæ free on their external edge; a single orifice for each operculum.					*Sturiones, or Chondropterygii, with free branchiæ.*	Sturgeons, &c.
		Branchiæ adherent at both their edges; several branchial openings. (*Chondropterygians with fixed branchiæ.*)	Lower jaw moveable.				*Selachii.*	Sharks, Rays, &c.
			Jaws united into an immoveable circle.				*Cyclostomi.*	Lampreys, &c.

LESSON VI.

ORDER OF ACANTHOPTERYGIANS.—*Family of Percoides, (Perches, Rock-fish.)—Family of Mulloides, (Red Mullets, Flying-fishes.)—Family of Mailed-cheeks.—Family of Scienoides.—Family of Sparoides.—Family of Menides.—Family of Squamipennes.—Family of Labyrinthiform pharyngeals.—Family of Scomberoides, (Mackerel.—Mackerel Fishery.—Tunny.—Sword-Fish, &c.)*

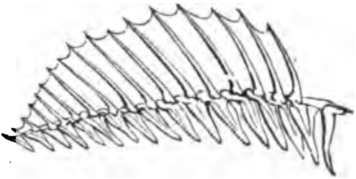
DIVISION OF OSSEOUS FISHES.

ORDER OF ACANTHOPTERYGII.

1. The Order of Acanthopterygians is easily recognised by the disposition of the branchiæ and upper jaw, and by the spinous fins. Three fourths of the fishes known, belong to this group; but these animals resemble each other in so very many respects, that in spite of the numerous differences we remark among them, we can only separate them into several natural families, all of which we are obliged to place in the same order

2. The first fin-rays of the back are always bony and spinous, (*Fig.* 46.) When there are two dorsal fins, these ***spinous rays*** only sustain the first; and when there is but one of these organs, they sustain at least its anterior portion; and we sometimes find them entirely free or separate. Generally there is also a bony ray to each ventral fin, and frequently the anal fin has some spines for its first rays.

Fig. 46.



3. This order is divided into six natural families, the most remarkable of which are, the Percoides, the Mulloides, the Mailed-cheeks, the Labyrinthiform Pharyngeals and Scomberoides.

4. The FAMILY OF PERCOIDES, (or fishes that resemble a Perch) is composed of fishes that have an oblong, more or less compressed body, covered with scales, which are generally hard; the mouth large, and armed with teeth, situate upon the front of the vomer, and almost always on the palate bones as well as the jaws, the branchial arches and pharyngeal bones; the operculum, or the bone situate immediately anterior to it, and therefore called pre-operculum, or ante-operculum, is dentate or spiny on its edge;

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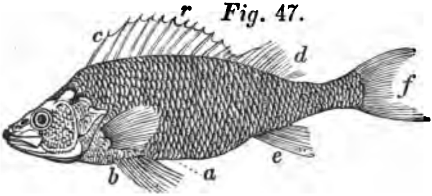
1. How is the Order of Acanthopterygians distinguished?
2. What is the character of their dorsal fins?
3. How is this order divided?

and the fins are always seven or eight in number. They have no beards upon the chin; in general, they are adorned with beautiful colours, and their flesh is very agreeable food.

5. Most of these fishes have the ventral fins attached beneath the pectoral; those in which this arrangement occurs are known under the name of *Thoracic Percoides:* they are sub-divided into two groups characterised by the number of the soft rays of the ventral fin, which is five in the one, and seven in the other. Among the first are those that have seven branchiostegous rays, (the small, thin, and elongated bones which sustain the gill-membrane, situate beneath the operculum, and serving to complete the external parietes of the branchial cavity,) two dorsal fins, and all the teeth very fine and close, like the pile on velvet; they are the *Perches*, the *Rock-Fish*, &c.

6. The Perches,—*Perca*,—are distinguished by their smooth tongue and by the spines and teeth on their opercula: they inhabit fresh water. The *Common Perch*,—*Perca fluviatilis*,—(*Fig.* 47.) which is greenish, with vertical, blackish bands, and the ventral and anal fins red, is found throughout Europe, as well as a great part of Asia, and the United States. It inhabits lakes, rivers, and running streams, and avoids salt, or brackish water, and ordinarily keeps at a depth of two or three feet. These fishes do not swim in numerous shoals; they feed on worms, insects and small fishes: they spawn in the month of April, and their eggs are joined together by a viscid matter in long cords, which interlace among reeds, &c.

Fig. 47.



COMMON PERCH.

7. The Rock-Fish, or Striped Basse,—*Perca labrax*,—is a sea-fish that has the tongue covered with asperities, and the opercula somewhat different, but which, in other respects, closely resembles the Perches. On the sides are parallel lines, like narrow ribbons, eight in number, which give it the name of Striped Basse; the scales are large, of a metallic lustre, and the operculum is serrated in the middle plate. This fish abounds on our own coast, and is much esteemed as an article of food.

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4. How is the family of Percoides distinguished?
5. What are Thoracic Percoides?
6. What are the characters of the Perches? What are the characters of the common Perch? What are its habits?
7. What are the characters of the Rock-fish or Striped Basse?

8. The **Family of Mulloides** differs but little from that of the percoides, but is easily distinguished from it, by the large scales with which the whole body of these fishes is covered, and by two long cirri or beards which hang from under the lower jaw. It is composed of the Mullets properly so called, of which two species are found in Europe, namely: the Red Mullet, and Surmullet.

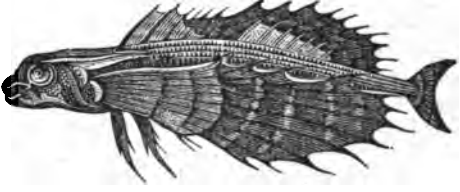
9. The *Red Mullet,—Mullus barbatus,*—has the body and tail red, even after the scales have been removed; its size is ordinarily from eight to ten inches. It lives in many seas, particularly in the Mediterranean, and is much prized for the excellent taste of its flesh. It is celebrated on account of the pleasure which the Romans took in contemplating the changes of colour it displays while dying. Exorbitant prices were paid for Mullets of extraordinary size, and at entertainments, they were brought to the table alive, and cooked before the eyes of the guests.

10. The *Surmullet,—Mullus surmuletus,*—is larger than the Mullet, and is longitudinally striped yellow; it is more common in the ocean, but its flesh is less esteemed.

11. The **Family of Mailed-cheeks,** — ***Buccæ loricatæ,*** — is recognised by the manner in which the sub-orbital bones are prolonged to the opercula and protect the cheeks.

12. In this family are placed the Fying Fishes,—***Dactylopterus,***—in which the pectoral fin-rays are very numerous, and united by a membrane so as to form very large pectoral fins, (*Fig.* 48.) which they use as wings, to sustain themselves in the air when they spring out of water, in the hope of escaping from their enemies. Voyagers meet with them in the Mediterranean, but particularly in the tropical seas; they swim in numerous shoals, which the bonita and other voracious fishes, fiercely pursue, and when, to escape this danger, they spring into the air, another, not less great, awaits them; for a host of sea-birds, such as the Frigate and Phaeton, also pursue them, and embrace this opportunity to

Fig. 48.



FLYING-FISH OF THE MEDITERRANEAN.

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8. How is the family of Mulloides distinguished?
9. What is the Mullet?
10. What is the Surmullet?
11. What are the characters of the family of Mailed-cheek?
12. What are the characters and habits of Flying-fishes?

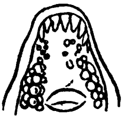
pounce upon them. These fishes cannot go very far in this way; because the drying of the membrane which unites the rays of the pectoral fins forces them soon to fall back again into the sea.

13. The **Family of Scienoides** resembles the Percoides, but is distinguished from them by the absence of teeth on the vomer and palate. In general, the bones of the cranium and face are cavernous, and the muzzle is more or less inflated. Almost all the fishes of this group are good to eat, and many of them are exquisite. To this family belong the Umbrina, which is a large, good fish, the Corvina which is found in the Mediterranean, and the Drum-fishes or Pagonias which inhabit our own coast; the last are remarkable for the noise they make, which is compared to that of a drum.

14. The **Family of Sparoides** has neither the inflated muzzle, nor spiny operculum of the preceding; but the palate is free of teeth, and the body is covered with scales of greater or less size, and the mouth is not protractile.

15. In the first tribe of this family, called *Sparus*, we find on each side of the jaws, round molar teeth, in form of paving stones, (*Fig.* 47.); sometimes there are also, in front of the jaws, two cutting incisor teeth, almost similar to those in man, (it is the case in the *Sargus*,) some species of which live near the Mediterranean coasts: at other times, we only find in front, some conical or blunt teeth. The *Daurades,—Chrysophris,*—are recognised by this latter character, and by the existence of at least three rows of molar teeth in the upper jaw. The *Common Daurade* is frequent on the coast of Britany, as well as in the Mediterranean. Its body is oval, and its mouth is furnished with four rows of molar teeth above, and five below. It derives its name from its golden colour.

Fig. 47.



TEETH OF A SARGUS.

16. The small family of **Menides** is composed of fishes that very much resemble the Sparoides, but which are distinguished from them by the mouth, which is very protractile, and, at the will of the animal, converted into a tube.

17. The **Family of Squamipennes** is recognised by having the soft, and sometimes the spinous part of the dorsal and anal fins covered by scales, and difficult to distinguish from the mass of the body, which is compressed and also scaly. Some of the Scienoides also have the fins incrusted with scales: but they

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13. What are the characters and habits of the Scienoides?
14. How is the family of Sparoides characterised?
15. How are the Daurades recognised?
16. How are the Menides distinguished from the Sparoides?
17. What are the characters of the Squamipennes?

never have the teeth in the form of flexible bristles as in most of the Squamipennes, and their inflated muzzle is often sufficient to distinguish them.

18. The Squamipennes, in which the jaws are furnished with several ranges of teeth, similar in conformation and arrangement to the hairs of a brush, have been united under the name of CHÆTODON. Their mouth is very small, and the dorsal and anal fins are so covered with scales that it is difficult to distinguish them from the body: they are very numerous in the seas of hot regions, and very remarkable for the beauty and variety of their colours.

19. The CASTAGNOLES,—*Brama*,—and the ARCHERS,—*Toxotes*, &c. differ from the Chætodons in many respects, particularly in having teeth on the vomer and palate. The first have the muzzle very short, the forehead vertical and a very small number of spinous rays concealed in the anterior portion of the dorsal fin: they inhabit the Mediterranean. The Archers, or shooting fishes have the forehead very oblique, and the dorsal fin very far back, armed with strong spines, and not covered by scales. The common species,—*Toxotes jaculator*,—inhabits the Ganges, and the seas of India; it is celebrated on account of the manner in which it projects drops of water on insects that frequent aquatic plants, in order to throw them down and feed on them. They throw a drop three or four feet high, and rarely miss their aim. This singular instinct is common to a species of Chætodon that inhabits the same places.

20. The FAMILY OF LABYRINTHIFORM PHARYNGEALS, is a small family remarkable for possessing very complicated cells above the branchiæ. These cells, enclosed beneath the operculum and formed by the lamellæ of the pharyngeal bones, serve to retain a certain quantity of water which keeps the branchiæ humid, when the animal is exposed to the air, and enables it to live in this way for a considerable time: these fishes are in the habit of leaving the rivers and pools, their ordinary abode, and going to considerable distances by crawling on the grass or on the land. Those that possess this labyrinthiform apparatus in the highest degree of complication, and which have received the name of ANABAS, not only remain a long time out of water, but also, as we are assured, climb trees. Most of the fishes of this family inhabit India and China.

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18. What are the Chætodons?

19. What are Castagnoles? What are the characters of the Shooting-fish?

20. What are the characters of the Labyrinthiform pharyngeals? What are their habits?

21. The FAMILY OF SCOMBEROIDES is the most important of this order; it comprises many fishes of considerable size, the taste of which is excellent, and the fecundity so inexhaustible, that, in spite of the continued destruction to which they are subject, they return yearly in immense legions to the same localities, and offer themselves as a certain prey to the activity of fishermen, and to the industry of those who make it a business to prepare and preserve them. The Tunny, the Bonita, and Mackerel, which are so useful to man, and form a type of this family, are easily distinguished from other Acanthopterygians; but many of the species that are naturally grouped around them possess none of the marks which make them known, and establish such close relations with other families, that the limits of the latter are difficult to define. In general, the Scomberoides have very small scales, and a large part of the skin smooth; they have neither spines nor teeth on the pieces of the opercula; their vertical fins are not scaly; the tail, and the caudal fin especially, are ordinarily large and very vigorous. Most of them have the sides of the tail carinate or armed with scales in form of a shield; and in many, the posterior rays of the second dorsal, and anal fins, are separated, and form so many *false fins*, or *spurious fins.*

22. Those which possess these last characters, and have the dorsal fin continuous, form the tribe of SCOMBER. Their body is in the form of a spindle, the tail is short, and more or less carinate laterally, but not armed with shields, and the caudal fin is very large: they are excellent swimmers. This family includes the Mackerel, the Tunny, the Sword-Fish, &c.

23. The MACKERELS,—*Scomber*,—are distinguished from the other Scomberoides by the uniformly small and smooth scales with which the body is covered, by two small cutaneous crests situate upon the sides of the tail, and by a vacant space that separates the two dorsal fins.

24 The *Common Mackerel,—Scomber scombrus,*—has a blue back, marked with undulating black stripes, and five false fins. It is a migratory fish, and at certain seasons abounds on the coasts of the United States, and Europe. The importance of the mackerel fishery may be estimated from the fact that in the state of Massachusetts, no less than 308,462 barrels were packed during the year 1830. On the western coasts of England, this fishery is conducted with nets at night by torch-light; the fisher-

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21. What are the characters of the Scomberoides?
22. What are the characters of the tribe of Scomber?
23. What are the characters of Mackerel?
24. What are the characters of the common Mackerel?

men spread themselves over several leagues and cast their nets, which are sometimes more than a league in extent, in the direction pursued by the shoals of mackerel. The meshes of the net are of a size to receive the head of a moderate sized fish, but arrest it by the fins, and when it endeavours to extricate itself, its gills become entangled, and it is held prisoner. Mackerels are also caught by the hook and line.

25. The genus of *Tunny,—Thynnus,*—is closely approximated to that of the Mackerel, from which it is distinguished by a sort of corselet around the thorax formed of scales which are larger and not so smooth as those on the rest of the body.

26. The *Common Tunny,—Scomber thynnus,*—resembles the mackerel in the general form of its body; but it is rounder, and attains a larger size; in general, its length is three or four feet, but sometimes it attains to more than fifteen. This fish is sometimes seen in the ocean; but it abounds especially in the Mediterranean; at certain periods it coasts along the shores in innumerable legions, and gives rise to very important fisheries, which have been carried on in the Mediterranean from the remotest antiquity, and constitute a chief source of the wealth of Provence, Sardinia, &c One of the most remarkable modes of taking the Tunny, is by what is termed the *Madrague.* This name is given to a sort of labyrinth constructed of nets stretched out vertically in the sea, and so arranged as to form a series of chambers, open from the land side by a sort of door, and united by another net which bars the passage and arrests the tunnies in their periodical course along the shore. These fishes at first pass between the shore, and the chambers destined to receive them; but, arrested by the net mentioned above, they turn towards the high sea, and enter the labyrinth where they become confounded, and fall an easy prey.

27. On the coast of the United States they do not run in shoals. They are occasionally taken in baiting other more common fishes. In Europe, the flesh of the Tunny is very much esteemed, it resembles beef, and is preserved either by the aid of salt, or by boiling and immersing in oil.

28. The *Bonita,—Scomber pelamys,*—celebrated on account of its pursuit of Flying-fishes in the tropics, is a species of Tunny, which may be recognised by the longitudinal brown stripes with which its belly is marked.

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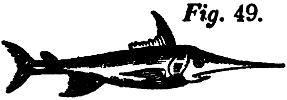
25. How is the genus Tunny distinguished from that of Mackerel?
26. What are the characters of the common Tunny?
27. Are Tunnies caught in the waters of the United States?
28. What are the characters of the Bonita?

29. The *Tribe of Sword-fishes*, is distinguished from all other fishes of the same family, by the beak, or long sword-like point, which terminates the upper jaw, (*Fig*. 49.) and forms a powerful weapon with which these fishes attack the largest marine animals.

Fig. 49.



SWORD-FISH.

30. The *Sword-fishes properly so called,* — *Xiphias,* — are without ventral fins, and the prolongation of the muzzle is flattened horizontally, and is cutting like a broad sword blade. But one species is known,—*Xiphias gladius,*—which is often fifteen or even more feet in length; it is more common in the Mediterranean than in the Atlantic. The flesh, which is white and compact, is delicate. This fish is not uncommon near our own coasts, and is often taken with the harpoon.

31. Another tribe, called *Centronotus*, is characterised by the absence of the membrane that unites the rays of the first dorsal fin, which consequently remain free. Among other fishes belonging to this tribe is the *Pilot-fish,*—(*Naucrates*, or *Scomber ductor*,)—so called from its habit of following vessels, to seize what may be thrown overboard, and also from the habit attributed to it, of conducting the Shark, which, directed by the same instinct, also very frequently accompanies vessels at sea with great perseverance. They have a fusiform body, very small scales, nearly the same as the mackerel, and cartilaginous carinæ on the sides of the tail like the Tunny. The common species is about a foot long.

32. The Family of Tænioides is composed of Acanthopterygians, which approximate the Scomberoides; they also have very small scales, but are distinguished by an extremely elongated body, very much flattened on the sides, the form of which has obtained for them the name of Ribbon-Fishes.

33. The Family of Theutyes also resembles the Scomberoides. It is composed of a small number of fishes, the body of which is compressed and oblong, with a small mouth, but slightly, if at all protractile, and armed in each jaw, with a single row of cutting teeth; the palate and tongue are without teeth, and there is but one dorsal fin. The Theutyes are herbivorous. The Acanthuri, called *Surgeons*, on account of a large, moveable

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29. How is the tribe of Sword fishes distinguished?

30. What are the characters of the Sword-fish properly so called?

31. What is the Pilot Fish?

32. How are the Tænioides distinguished?

33. What are the characters of the family of Theutyes? What are the Acanthuri?

spine, sharp as a lancet, which they have on each side of the tail, with which they inflict severe wounds on those who imprudently take hold of them, belong to this family.

34. The Family of Mugiloides, is distinct from all the preceding, and is characterised by an almost cylindrical body, covered with large scales, a slightly depressed head, and short muzzle, a transverse mouth armed with extremely fine teeth, two separate dorsal fins, ventral fins attached behind the pectoral, &c. They constitute a single genus, the Mullets,—Mugil,—which are much esteemed.

LESSON VII.

Order of Abdominal Malacopterygians.—*Division.*

Family of Cyprinoides.—*Carp—Gold-fish.—Gudgeon.—Tench, &c. &c.*

Family of Esoces.—*Pike.—Exocets, or Flying-fishes.*

Family of Siluroides.—*Electric Silurus, &c.*

Family of Salmonides.—*Common Salmon.—Salmon Fishing.—Trout.—Smelt.*

Family of Clupeæ.—*Herrings.—Herring Fishing.—Shad.—Sardines.—Anchovies, &c.*

ORDER OF MALACOPTERYGII ABDOMINALES.

1. This division is composed of Osseous Fishes that have the upper jaw moveable, simple pectinate branchiæ, the fin-rays cartilaginous: their ventral fins are suspended beneath the abdomen and behind the pectoral fins, without being attached to the bones of the shoulder.

2. It is composed of five families, namely: the *Cyprinoides*, comprising those fishes that resemble Carp; the *Esoces*, or Pikes, &c.; the *Siluroides*; the *Salmonides*, the type of which is the common Salmon; and the *Clupeæ*, or Herrings, and other fishes having the same organization. They may be distinguished by the following characters:

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34. What are the characters of the family of Mugiloides?

1. What are the general characters of the Abdominal Malacopterygians?

2. How is this order divided?

				(Families.)
MALACOPTERYGII ABDOMINALES.	Without an adipose fin on the back.	Margin of the upper jaw formed almost entirely by the intermaxillary bones.	Mouth small, weak, and often unprovided with teeth, except around the pharynx. Body scaly.	CYPRINOIDES
			Mouth large, and armed with strong, pointed teeth. Body ordinarily covered with very small scales.	ESOCES.
		Margin of the upper jaw formed in the middle by the intermaxillary bones, and on the sides by the maxillary bones. Body scaly.		CLUPEÆ.
	Having an adipose fin on the back.*	Body scaly, - - - - - - - - - -		SALMONIDES.
		Body unprovided with true scales, -		SILUROIDES.

* We give the name of *adipose fin* to any fin that is not sustained by fin-rays, and only consists of a fold of skin filled with fat.

3. The CYPRINOIDES,—*(Cyprinidæ,)*—have a slightly cleft mouth, weak jaws, most frequently without teeth, and a scaly body, without an adipose dorsal fin. They are the least carnivorous of the fishes.

4. One of the principal tribes of this family is the CYPRINUS, which is composed of fresh-water fishes, and includes the *Common Carp*, the *Gold-fish*, the *Barbel*, the *Gudgeon*, the *Tench*, &c. This group is characterised by the absence of teeth in the jaws, by the existence of a single dorsal fin, and ordinarily the scales are large. Most of these fishes feed on grains, herbs, &c. They have in the back part of the mouth a masticatory apparatus for crushing their food.

5. The *Carps*,—*Cyprinus*,—are distinguished by their long dorsal fin which, as well as the anal, is provided with a more or less strong spine for the second fin-ray.

6. The *Common Carp*,—*Cyprinus carpio*,—is found in all Europe, but has not yet been met with in the United States. It delights in tranquil waters, and is easily reared in rivers and ponds; the duration of its life is very long, and it is exceedingly prolific.

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3. What are the characters of the family of Cyprinoides?
4. What are the characters and habits of the tribe of Cyprinus?
5. How are the Carps distinguished?
6. Where is the common Carp found? What are its habits?

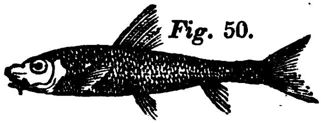
When young, the growth of Carps is very rapid, and at six years old they weigh about three pounds; they often attain three or four feet in length. During the winter, they bury themselves in the mud, and pass many months without eating.

7. The *Golden Carp*, or *Gold-fish*,—*Cyprinus auratus*,—is reared in garden ponds, and vases, on account of the beauty of its colours, which are a mixture of black, a beautiful golden red and silvery white.

8. The *Barbels*,—*Barbus*,—resemble the Carps, but their dorsal fin is shorter. The *Common Barbel*,—*Cyprinus barbus*,—abounds in clear running waters, and sometimes attains more than ten feet in length.

9. The *Gudgeons*,—*Gobio*,—also resemble the Carps; but they have no bony spine, (*Fig.* 50.) in the anterior part of the dorsal and anal fins; the mouth is surrounded with cirri, or beards. There is one species which abounds in the rivers of France, and though small, is much esteemed for its taste.

Fig. 50.



GUDGEON.

10. The *Tenches*,—*Tinca*,—in addition to the characters of the Gudgeons, have very small scales, and very short cirri. The *Common Tench*,—*Cyprinus tinca*,—inhabits stagnant waters in France; it is generally of a yellowish brown, attains about a foot in length, and is less esteemed than the Carp.

11. The *Breams*,—*Abramis*,—have neither spinous fin-rays nor cirri; their dorsal fin is short, but the anal is long. Two species are found in France. In the United States they are small.

12. The *Shiner*,—*Cyprinus crysolencas*,—is among the smallest of fresh-water fishes, being usually less than an inch in length. Shiners are the prey of their larger neighbours, and the sport of school-boys, who angle for them with a crooked pin.

13. The *Minnow*,—*Cyprinus atronasus*,—is another of the very small fishes, scarcely exceeding an inch in length. It is found in the brooks in every part of New England and the Middle States.

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7. What is the Gold-fish?
8. What are Barbels?
9. What are the characters of Gudgeons?
10. How are Tenches characterised?
11. What are the characters of Breams?
12. What is the Shiner?
13. What is the Minnow?

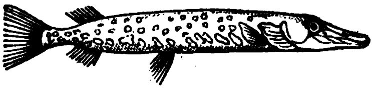
14. The *Roaches,—Leuciscus,*—form several species, all of which are small. The *Common Roach, — Leuciscus vulgaris,*— acquires seven or eight inches in length, and is remarkable for its brilliant scales, which are easily detached; they are silvery on the sides, and under parts of the body. The nacreous substance which gives them this metallic appearance, is employed in the arts for the manufacture of false pearls.

15. The *Suckers,* or *Loaches,—Cobitis,*—have a mouth unprovided with teeth; but it is surrounded by lips fitted for sucking. Their head is small; the body is elongated, covered with small scales, and enveloped in a mucosity or slime; their ventral fins are very far back, and over them is found a single small dorsal fin.

16. The FAMILY OF ESOCES, which comprises the Pikes and analogous fishes, has no adipose fin; it is distinguished from the preceding by the conformation of the mouth, and the existence of teeth.

17. The PIKES,—*Esox,*—are recognised by their oblong, obtuse, broad, depressed muzzle; they have but one dorsal fin which is placed opposite to the anal, (*Fig.* 51.) and nearly the whole entrance of the mouth, as well as the jaws, are full of teeth. The *Common Pike,—Esox lucius,*—is found in the fresh waters of Europe and North America. It is less common in the south than in the north, and is every where sought for its flesh, which is savoury, and of easy digestion. It is the most voracious and most destructive of all the fresh water fishes; it devours with avidity, frogs, young ducks, and all the fishes that come in its way. It often seizes animals larger than itself, and its presence in a pond is sometimes enough to depopulate it in a short time. Pikes four or five feet long, are not rare in the great lakes of northern Europe, and one of still larger size has been seen. In 1497, a Pike was caught at Kaiserlautern, near Manheim, which was nearly nineteen feet in length, weighing three hundred and fifty pounds. This giant was as remarkable for its great age, as for its size: for there was found upon it a gilt copper ring bearing this inscription: "I am the first fish that was thrown into this pond, by the hands of Frederick II. October 5, 1230;" it was consequently, at least

Fig. 51.



PIKE.

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14. What are Roaches? For what purpose are their scales used?
15. What are the characters of Loaches?
16. What fishes compose the family of Esoces?
17. How are the Pikes characterised? What are the habits of the common Pike?

two hundred and sixty seven years old. The growth of these fishes is very rapid; the first year they are often ten or eleven inches in length, and in the second, fifteen.

The *Sea Pike,—Esox belone,*—also known as the gar-fish, spit-fish, and bill-fish, belongs to this family.

18. Exocets, (or Flying-Fishes, as they, as well as the *Dactylopterus*, (*Page* 93.) are also commonly called,)—*Exocetus,*—belong to the same family as the Pikes, and are recognised at first sight by the excessive length of their pectoral fins, which are long enough to serve them as wings, and sustain them for a few seconds in the air. They swim in shoals, and are pursued by legions of voracious fishes, to escape from which they spring out of water; but they soon fall again, because their wings only serve them as a parachute; and, while on their aerial course, they become the prey of sea-birds, as well as of sharks and other fishes.

19. The Family of Siluroides differs from all other abdominal malacopterygians, in the absence of true scales. The skin is naked, or furnished with bony plates. The dorsal and pectoral fins have almost always, a strong articulated spine for the first fin-ray, and, as in the next family, there is often one adipose fin posteriorly; and the mouth also has some peculiarities of structure.

20. Most of these fishes belong to the tribe of Silurus, which is recognised by the naked skin, by the mouth cleft at the end of the muzzle, and by a strong spine that, in general, constitutes the first ray of the pectoral fin, which is articulated with the shoulder, and so arranged, that it can be approximated to the body, or raised perpendicularly to it, and thus used as a dangerous weapon. The *Siluri properly so called*, have a small fin on the fore part of the back, sustained by rays. One species of this genus, the only one in France, is the largest fresh water fish of Europe. Its length ordinarily exceeds six feet, and its weight is often three hundred pounds. The Cat-fish belongs to this tribe.

21. The *Malapteruri* differ but little from the *Siluri*, from which they are distinguished by the absence of a rayed fin on the back, and by some other characters. The famous *Silurus electricus* of the Nile, is the only species belonging to this division: like the Torpedo and Gymnotus, it possesses the power

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18. What are the characters and habits of the fishes of the genus Exocetus?

19. What are the characters of the family of Siluroides?

20. What are the characters of the tribe of Silurus?

21. What are the characters of the Silurus electricus? Where is the electric organ situate?

of giving strong electric shocks; it appears that the seat of this faculty is in a peculiar tissue, situate between the muscles and the skin, and having the appearance of a fatty cellular structure. This fish which inhabits the Senegal as well as the Nile, is eighteen or twenty inches in length. The Arabs call it *raasch*, which signifies *thunder*.

22. The Family of Salmonides, of which the Salmons are the type, are characterised by a scaly body, and a first dorsal fin with soft rays, followed by a second which is small and adipose, that is, formed of a fold of skin filled with fat, and without rays.

23. The most interesting genus of this family, is that of the *Salmons,—Salmo,*— which have the mouth more completely armed with teeth than any other fish; they are naturally voracious, and ascend very far up rivers to deposit their eggs; their body is almost always spotted, and their flesh is much esteemed

24. The *Common Salmon,—Salmo salar*—is the largest species of the genus; its flesh is red, its body elongated, and flattened laterally, and it often attains six feet in length. It is found in great numbers in all the Arctic seas, whence it ascends rivers in large shoals every spring. It swims with great rapidity, and can clear at a leap, obstacles in its passage, twelve or fifteen feet in height. When they fall in with a cave, or some other place favourable for spawning, they deposit their eggs in a hole in the sand, and then permit themselves to be carried by the current to the sea, where they go, to acquire strength to return again the following year. Young salmons are therefore born in the rivers, but their growth is rapid, and when they attain the size of about twelve inches, they descend to the sea like the adults.

25. The salmon fishery, in many countries, forms a very important branch of industry. In Norway, as many as 300 of these fishes have been caught at a single cast of the net; and in the river Tweed as many as 700; the time selected for catching them is when they ascend rivers to spawn, for after they have deposited their eggs and are on their way to the sea, they are lean, and their flesh is of little value. In general, this fishery is conducted with nets stretched across the river, and so arranged, that the salmons are caught in the meshes: but sometimes, in Scotland, for example, they are taken with a spear or harpoon. They are also caught with a hook and line.

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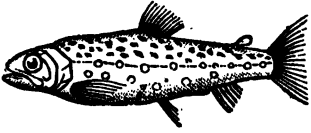
22. What are the characters of the family of Salmonides?
23. What are the general characters of the genus of Salmons?
24. What are the characters of the common Salmon? What are its habits?
25. What is the mode of catching Salmon?

26. The *Salmon Trout*,—*Salmo trutta*,—like the salmon has reddish flesh, and the caudal fin crescent shaped: but it has on all the under parts of the body, a great number of black spots, ocellate, or in form of an X; it sometimes weighs eight or ten pounds.

27. The *Common Trout*,—*Salmo fario*,—has the caudal fin but little notched, and its flesh is white: (*Fig.* 52.) it is also distinguished by the brown spots on the back, and red spots surrounded by a bright circle on the flanks, which are on a ground, the shade of which varies from white and golden yellow, to a deep brown. It is commonly from twelve to fifteen inches in length, weighing about a pound; but it is sometimes met with of larger size. It inhabits rivers in the northern parts of Europe and the United States. Many other river Trouts are known, which are chiefly found in lakes and mountain streams, and which vary in their size and colours in each locality; some naturalists regard them as different species, and others look upon them as simple varieties, resulting from age, food, and the quality of the waters in which they dwell.

Fig. 52.



COMMON TROUT.

28. The Smelts,—*Osmerus*,—also belong to the family of Salmonides; they differ from the preceding in the almost total absence of teeth on the vomer, in the number of the branchiostegous rays, which is eight in place of ten, and in the absence of spots on the body. They are caught in the sea at the mouths of large rivers; their flesh is excellent. The *Common Smelt*,—*Osmerus eperlanus*,—is small: it is ornamented with the most dazzling silvery and light green tints. The skin is so exceedingly thin that, under the microscope, the blood may be seen circulating in the cutaneous vessels.

29. The Graylings,—*Thymallus*,—have jaws like the Trout; but the mouth is but slightly cleft, and the teeth are very fine. They have the habits of the Trout, and their flesh is equally esteemed. The *Common Grayling*,—*Salmo thymallus*,—is striped blackish longitudinally: it attains a size of eighteen inches, and in the spring, ascends several rivers of France and Italy. It is especially met with in the pure, limpid waters of the mountains of America and Switzerland.

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26. What are the characters of the Salmon Trout?

27. What are the characters of the common Trout? Where is it found?

28. What are Smelts? What are the characters of the common Smelt?

29. What are the characters of Graylings?

The family of Salmonides comprises a great number of other genera.

30. The Family of Clupeæ has no adipose fin like the preceding; the upper jaw is formed, as in the trouts, in the middle, by intermaxillary bones without pedicles, and on the sides by the maxillary bones. The body of these fishes is always scaly, and most of them ascend rivers.

31. The most important tribe of this family is that of the Herrings, characterised by narrow, short, intermaxillary bones, and by the inferior edge of the body being compressed, the scales of which are so arranged as to form notches like the teeth of a saw. These fishes are remarkable for the fineness and great number of their *bones*, as well as for the peculiarities of their branchial apparatus.

32. Herrings properly so called,—*Clupea*,—have a moderate sized mouth, without a notch in front.

33. The *Common Herring*,—*Clupea harengus*,—is ordinarily eight or nine inches in length, the head small and compressed, the mouth slightly cleft, the lower jaw longer than the upper, the inferior edge of the body slightly carinate, the scales large, and slightly adherent, the back bluish, and the belly silvery. It inhabits the northern seas, and arrives every year in innumerable legions upon different parts of the coasts of Europe, Asia, and America, but does not go very far south of the fortieth degree of north latitude. Some naturalists suppose that all herrings periodically retire beneath the ice of the polar seas, and set out from this common retreat in an immense column, which, dividing, spreads along almost all the coasts north of the parallel above named; but this distant emigration, and this common rendezvous in the arctic regions, are far from being demonstrated, and there is reason to believe that such is not the case.

34. In the months of April and May, herrings begin to appear in the waters of the Shetland Islands, and towards the end of June, or in July, they arrive in incalculable numbers, forming vast and dense shoals, which sometimes extend over the surface of the sea for several leagues, and hundreds of feet in thickness. In September, they arrive on the coasts of Great Britain. From that region they cross the Atlantic in a south westerly direction, and make their appearance on the coast of Georgia, about the

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30. What are the characters of the Family of Clupeæ?
31. What are the characters of the tribe of Herrings?
32. How are Herrings properly so called distinguished?
33. What are the characters of the common Herring?
34. Where are Herrings found?

last of January; detachments then begin to move eastward, and by the end of April, the whole American sea-board is lined with them.

35. The herring fishery is one of great importance. It occupies every year entire fleets, and formerly, it was carried on with still greater activity. About the middle of the 17th century, the Dutch employed not less than two thousand vessels, and it is estimated that eight hundred thousand persons, in the two provinces of Holland and West Friesland, derived their living from this branch of industry alone. The Norwegians, the Americans, the Scotch, the English, and even the French embarked in this fishery in considerable numbers, and though its importance is now considerably lessened, it is still a great source of wealth to the people bordering the northern seas.

36. This fishery is ordinarily conducted with nets five or six hundred fathoms in length, the lower edge of which is loaded with lead, while the upper edge is made to float on the surface by means of buoys; the meshes are just large enough to receive the head of a herring as far as the gills, but not allow the pectoral fins to pass. The fish, in endeavouring to overcome the obstacle that this great vertical partition opposes to its passage, is thus *meshed*, and, not being able to advance or recede, owing to the gills and fins, he remains a prisoner, until the fishermen draw the net on board. This is termed a *gill-net.* The number of herrings, taken in this way, is sometimes so great, that the net bursts under their weight. Generally this fishery is carried on at some distance from the shore, and, for this reason, the herrings are salted on board. It is a prejudice to suppose that the herrings caught on our own coasts are inferior to those that fall into foreign nets.

37. The *Sardine,—Clupea sardina,*—is a small species of Herring, celebrated for the great delicacy of its flesh. It inhabits the Atlantic, the Baltic, and the Mediterranean. During winter it keeps in the depths of the sea; but about the month of June it draws near the shore in immense shoals. As many as forty, and even fifty thousand have been caught at a single cast of the net. Sardines are caught in the same way as Herrings, but the meshes of the net are smaller, and the fishermen, to attract the fish from time to time, throw into the sea, a peculiar bait, which is prepared from cod-fish eggs. From the mouth of the Loire to the extremity of Britany, this fish abounds every summer, and gives

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35. Is the Herring fishery important?

36. How are Herrings caught? What are the qualities of American Herring?

37. What are Sardines? How are they caught?

rise to productive fisheries: along the coast there are a great number of establishments for the preparation and preservation of Sardines.

38. There are many other species of Herring, among which is the *Pilchard*, which does not differ much from the Sardine, except that it is larger; the *Sprat*, which is smaller than the Herring, is also salted or pickled, and the *White-bait*, a very small fish of the most beautiful silver colour, with a black spot on the end of the muzzle.

39. Shads,—*Alosa*,—are distinguished from Herrings properly so called, by a notch in the middle of the upper jaw. The *Common Shad*,—*Alosa vulgaris*,—which attains three feet in length, and has no visible teeth, inhabits the sea, and in the spring ascends rivers in numerous shoals. At this period their flesh is excellent; but when the fish is caught at sea, it is dry, and possesses an unpleasant taste.

40. The *Alewife*,—*Clupea vernalis*,—holds a place between the shad and the herring, possessing the general characteristics of both. Its habits bear a striking resemblance to those two fishes; it ascends rivers to deposit its spawn, and afterwards retires to the ocean. It is found chiefly in the rivers of New England.

41. The Anchovies,—*Engraulis*,—also belong to this family; but they differ from the herrings in the mouth, which is cleft far behind the eyes, in their gills which are more open, and in some other characteristics. The *Common Anchovy*,—*Engraulis encrasicholus*,—is three or four inches long; the back is brown, and the flanks and belly silvery; it is found in the Mediterranean, as well as on the western coasts of France and Spain, in almost all parts of the North Atlantic Ocean, and in the Baltic Sea. At a certain period of the year, which varies in different localities, it leaves the high sea and approaches the coast to spawn, when it becomes the object of an important fishery. To catch it, the French fishermen provide themselves with nets, which are about two hundred feet in length, and twenty-five or thirty in breadth, and assemble four boats, one of which carries the net, and the others furnaces, in which they make a bright fire; this fishery is carried on in dark nights from April to July; they station themselves about five miles from the coast; and when the anchovies, attracted by the light, are assembled in large numbers around a

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38. What other fishes belong to the genus of Herrings?

39 What is the characteristic difference between the Shad and Herrings?

40. What is the Alewife?

41. What are Anchovies? What are the characters of the common Anchovy? How are Anchovies caught?

boat thus illuminated, the net is cast into the water, and laid out so as to surround the assembled fishes; this done, the fire is suddenly extinguished, and the anchovies alarmed, in seeking to escape, are taken in the net. They are preserved with salt, after removing the head and intestines.

The family of Clupeæ embraces a great number of other genera, many of which possess remarkable peculiarities, but our limits will not permit us to describe them.

LESSON VIII.

Order of subbrachian Malacopterygians.—*Family of Gadoides.—Cods.—Common Cod.—Cod Fishery.—Whiting.—Hake.—Ling.*
Family of Pleuronectes.—*Organization.—Plaice.—Turbot.—Sole.—Family of Discoboli.*
Family of Echeneis.—*Remora.*
Order of Apodous Malacopterygians.—*Eels.—Common Eel.—Sea Eel.—Gymnotus electricus.*
Order of Lophobranchians.—*Organization.—Hippocampus.*
Order of Plectognathi.—*Organization.—Diodon.—Trunk-fish.*

ORDER OF MALACOPTERYGII SUBBRACHIATI.

1. This Order is distinguished from other Malacopterygians by the situation of the ventral fins, which are placed beneath the pectorals, the pelvis being suspended immediately from the bones of the shoulder.

2. The Subbrachian Malacopterygians constitute four families, namely: *Gadoides*, *Pleuronectes*, *Discoboli*, and *Echeneis*.

3. The Family of Gadoides is composed of Subbrachian Malacopterygians in which the body is a little compressed, and symmetrical, in which the ventral fins are sharpened to a point, and attached under the throat; they are covered with soft, small scales; most of them live in cold or temperate seas, and they afford to man an abundance of a good and wholesome food. In this family are placed the genera of Cod, Whiting, Ling, &c.

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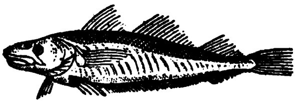
1. What are the characters of the Subbrachian Malacopterygians?
2. Into what families is this order divided?
3. What are the general characters of the family of Gadoides?

4. The Cods,—*Gadus*,—are distinguished by the existence of three dorsal, and two anal fins, and a cirrus at the end of the muzzle or snout. The most important species of this genus is the *Cod properly so called,—Gadus morrhua*,—a fish two or three feet long, with a gray back spotted yellowish, and a white belly. Cods are found in greatest abundance in the ocean between the fortieth and sixtieth degrees of north latitude. On the coasts of Norway, in the neighbourhood of Iceland, and especially in the waters of Newfoundland, they are found in incalculable numbers. During winter, they retire to the depths of the sea; but in the warm season, the necessity of casting their spawn and of providing for their subsistence, causes them to approach the shore, and fathomable waters. In some localities, the cod-fishery is conducted with seines four or five hundred feet in length, but generally they are caught with a hook and line, baited with herring, the gills of cod-fish, &c. A skilful fisherman may catch in this way, four hundred cod-fishes in a day. The fish is prepared in different ways for preservation; when simply salted, it is known in commerce as *green cod;* when dried without being salted, it is *stockfish;* and when salted and dried in the sun, it is called *dry-cod.* The tongues, salted or pickled with the swimming-bladders, are much esteemed, and known under the title of *tongues and sounds.* "The sound or swimming-bladder of the cod-fish, if rightly prepared, supplies an isinglass equal to the best Russian, and applicable to all the uses for which the imported is employed." The liver yields a large quantity of pure, limpid oil, *cod-liver-oil*, which, in many respects, and for most purposes, is superior to the commonly used fish-oil.

Catching and preparing cod-fish are very important branches of maritime industry. About twelve thousand French, and a very much larger number of English and American fishermen are yearly engaged in this business.

5. The Whitings,—*Merlangus*,—have the same number of fins as the cod, but no cirri. The *Common Whiting,—Gadus merlangus*,—(*Fig.* 53.) which is about a foot long, silvery beneath, reddish gray or olive above, may be recognised by the upper jaw being longer than the lower: it inhabits European seas, and is

Fig. 53.



COMMON WHITING.

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4. How is the genus of Cods recognised? What is the Cod properly so called? Where are Cods found? How are they caught? What is Stockfish? What are tongues and sounds?

5. What are the characters of the common Whiting?

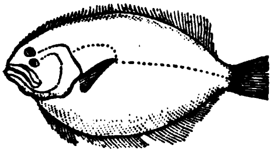
much esteemed for the lightness of its delicate flesh. On the coast of Britany it is salted and dried like the cod.

6. The Hakes,—*Merluccius*,—have no cirri, and differ from the cods in the number of their fins; they have but two dorsal fins, and one posterior to the anus. The *Common Hake,—Gadus merluccius*,—is from one to two feet in length, and sometimes much longer; the back is brown gray; the anterior dorsal fin pointed; lower jaw longest. The Hake is taken in great numbers, both in the Mediterranean and Atlantic; it is usually found in pursuit of mackerel shoals; when salted and dried, it receives, in the north, the name of *stock-fish*, which is also applied to the cod.

7. The *Lings,—Lota*,—have a greater or less number of cirri, and the same fins as the Hakes. They are almost as numerous as the cod in the northern seas. The *Common Ling* differs from other Gadoides in the almost cylindrical form of its body, in its depressed head and habits: it is the only fish of this family that ascends rivers into fresh water. Its flesh is much esteemed.

8. The Family of Pleuronectes, comprises what are vulgarly called the *Flat-Fishes;* these animals have the body very much compressed laterally, and very much elevated vertically; but what especially distinguishes them is a want of symmetry in the head, a character which is not observed in any other vertebrate animal, (*Fig.* 54.) Both eyes are placed on the same side, which is always uppermost when the animal swims, and is always deeply coloured, while the opposite side is always whitish. The two sides of the mouth are unequal, and it is rare to find both pectoral fins perfectly alike; the dorsal fin extends along the whole back; the anal fin occupies the lower part of the body, and the ventrals seem to be continuous with it in front, as they are almost united one to the other. They want the swimming-bladder, swim on the side, and seldom quit the bottom.

Fig. 54.



FLAT-FISH.

9. The principal genera of this family, are the Plaice, the Turbot, and the Sole.

10. The Plaice,—*Platessa*,—have in each jaw, a row of cutting, and obtuse teeth; most generally, the pharyngeal bones

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6. How are Hakes characterised? What are the characters of the common Hake?

7. How are Lings characterised?

8. What are the peculiarities of the family of Pleuronectes?

9. What are the principal genera of this family?

10. What are the characters of Plaice?

are furnished with teeth like pebbles; the dorsal fin extends as far forward as a point above the upper eye, leaving a naked interval between it and the caudal fin; their form is rhomboidal, and most frequently their eyes are on the right side.

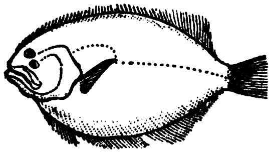
11. The *Common Plaice,—Platessa platessa,*—is easily recognised by six or seven tubercles, forming a straight line on the right side of the head. between the eyes, and by the pale yellow spots which relieve the brown on the same side of the body; it is three times as long as it is high, and its scales are thin and soft. Its flesh is very tender and much esteemed: its weight sometimes reaches sixteen pounds. It is common on the coasts of France, and abounds on those of Holland.

12. The *Flounder,—Platessa flesus,*—resembles the common plaice, but only has small granules between the eyes, and has a small rough button at the base of each ray of the dorsal and anal fins. It inhabits our coast, and ascends rivers. In many individuals the eyes are on the left, instead of the right side of the head.

13. The *Limande*, or *Dab,—Platessa Limanda,*—has a projecting line between the eyes, and a body which is comparatively higher than it is long. Its scales are rougher than in any of the preceding species, from which circumstance it has derived its name, (from *Lima*, a file); the teeth are straighter; and the side upon which the eyes are placed is light brown with some faded brown and whitish spots.

14. The *Holibut,—Hippoglossus vulgaris*, or *Platessa Hippoglossus,*—has the form and fins of a Platessa, but the jaws and pharynx are armed with teeth, which are most commonly strong and pointed. The eyes are on the right side. It is a voracious fish, and is found in the northern seas, and our own coast. It is taken with a line, and sometimes weighs five hundred pounds.

Fig. 55.



TURBOT.

15. The *Turbot,—Platessa maximus,*—has a rhomboidal body, almost as high as it is long, and studded on the brown side with small tubercles; the eyes are close together, and there is a projecting crest between them. It is probably the most valuable of the flat-fishes, and excepting the holibut, grows larger than any of the others. It is highly prized in England. It is also met with on our own coast.

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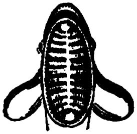
11. How is the common Plaice recognised?
12. How is the Flounder characterised?
13. What are the characters of the Limande?
14. What are the characters of the Holibut?
15. What are the characters of the Turbot?

16. Soles,—*Solea*,—have an oblong body, a round projecting snout, the dorsal extending from the mouth to the anal fin, and the mouth distorted and armed with teeth on one side only. The *Common Sole*,—*Platessa solea*, or *Solea vulgaris*,—is olive brown on the right side and grayish on the left. It is found on our own coast, chiefly at the mouths of rivers, and is an excellent fish.

17. The Family of Discoboli is composed of a small number of Subbranchian Malacopterygians, which have the ventral fins united in form of a disk. It includes two genera, in which are placed the Lump-Fish, and Lump Sucker.

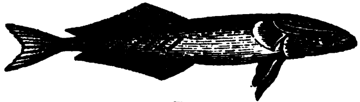
18. The Family of Echeneis, formed of a single genus, is remarkable among all fishes for a flattened disk, which covers the head, (*Fig.* 56.) it is composed of a certain number of moveable, transverse cartilaginous plates, standing obliquely backwards, by the assistance of which, the animal can attach itself to different bodies to which it applies this singular instrument. By this means, it often attaches itself to rocks, to vessels, and to other fishes, particularly to the shark. A species, which lives in the Mediterranean and the Atlantic, has been long celebrated under the name of *Remora*, or *Sucking-Fish*, (*Fig.* 57.) and its history is loaded with fable. It was pretended that this fish lived by a species of suction, which it exerted by means of the disk, (*Fig.* 56.) above mentioned, and the power of arresting the fastest sailing vessel in her course, was attributed to it. A species, similar to the preceding, is very common in the waters of the Isle of France, and it appears that, on the coast of Caffraria, it is employed in fishing, setting it off in pursuit of fishes, and drawing it in by a line attached to the tail, as soon as it has fixed itself to its prey.

Fig. 56.



THE DISK OF A REMORA.

Fig. 57.



THE REMORA.

ORDER OF MALACOPTERYGII APODA.

19. All the fishes of this order have an elongated form, a thick, soft, and but slightly scaly skin; but their chief characteristic is their want of ventral fins. They form a single natural family, Anguilliformes, which is composed of the tribe of eels, gymnotus, &c. &c

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16. What are the characters of Soles?
17. How is the family of Discoboli characterised?
18. What are the characters of the Remora?
19. How are Apodous Malacopterygians characterised?

20. Fishes of the tribe of Anguilliformes, have a long, slender body, and the scales, as it were, incrusted in a thick, fat skin; the operculum is small, surrounded by the branchiostegous rays, in form of a circle, which are enveloped in the skin, and open very far back by a hole or sort of tube, an arrangement which affords better protection to the gills, and enables these fishes to remain sometime out of water without perishing.

21. Eels,—*Muræna,*—are characterised by having pectoral fins, and the openings of the gills beneath them. Those which have the dorsal and caudal fins prolonged around the end of the tail, so as to form a pointed caudal fin, are designated under the name of Eels properly so called, and are again subdivided into Common Eels, and Conger Eels, according as the dorsal fin commences far from, or near to the pectoral fins.

22. *Common Eels,—Anguilla,*—are too well known to require description. Their colour varies acording to age, and, as it appears, according to the quality of the water in which they dwell. Those that inhabit limpid waters have a greenish back, striped brown, and a white or silvery belly, while those that are caught in the mud are ordinarily blackish brown above, and yellowish beneath. Eels are very voracious and extremely agile; they swim equally well backward and forward, and their skin is so slippery that it is difficult to hold them. During a great part of their life they inhabit fresh water, and frequent ponds and seas, as well as rivers. By day, they almost always keep buried in the mud or lie concealed in holes, they excavate near the shore. These holes are sometimes very extensive, and lodge a great number of eels; but, in general, their diameter is small, and they open externally at both ends, which enables the animal to escape more readily when threatened by danger. When the season is very warm, and the stagnant waters of the pools begin to putrify, the eels leave the bottom and conceal themselves in the herbage of the shore, or even cross the land in search of a more favourable locality: they can, in fact, crawl on the ground like serpents, and remain a considerable time in the air without perishing. Ordinarily they make these singular journeys during the night; and when it is extremely dry, they bury themselves in the mud, and continue there until the water returns. The length of time they can remain there without perishing is surprising. These fishes have been known to remain

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20. What are the characters of the Anguilliformes?

21. How are Eels characterised?

22. What are the characters of common Eels? What are their habits? Are they natives of salt or fresh water?

for months and even years in the mud of dried up pools, or in holes destitute of water, and nevertheless, regain their activity, the moment they were placed in their native element. This is not the only circumstance under which these fishes display their remarkable tenacity of life. They may be deprived of their skin, and their viscera, and be cut in pieces, without depriving the trunk of their body of the power of yet moving for some time. In early life, they inhabit the sea, and in the spring the young eels ascend rivers to dwell in fresh water, which, when full grown, they abandon to deposit their eggs in the sea.

23. The name of *Conger Eels* is applied to eels that differ very little from common eels, except that they are of large size, and always dwell in the sea or salt water.

24. MURÆNÆ PROPERLY SO CALLED,—*Muræna*,—are entirely without pectoral fins, and their branchiæ open on each side by a small hole. The most celebrated species is the ***Muræna helena***, which attains more than three feet in length, and is marbled throughout with brown and yellowish; it is widely spread over the Mediterranean, and was very highly esteemed by the ancients. The Romans reared them in great numbers, in their magnificent fish-ponds, decorated them with jewels, and taught them to come at the sound of their master's voice. Hirrius was the first to consecrate fish-ponds exclusively to murænæ, and he caused six thousand of these fishes to be served up at an entertainment, given to Cæsar when he was named dictator.

25. The GYMNOTI, which have the gills partially closed by a membrane, but opening in front of the pectoral fins, also belong to this order. The *Gymnoti properly so called,—Gymnotus,*—have, like the other fishes of this division, a ventral fin, which extends under the greater part of the body, but they want the fins at the end of the tail, and their skin is without perceptible scales. They inhabit the rivers of South America, and one of them, the *Electric Eel,—Gymnotus electricus—(Fig.* 58.) is celebrated on account of the

Fig. 58.

GYMNOTUS ELECTRICUS.

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23. What are Conger Eels?

24. What are the characters of Murænæ properly so called? What are the characters of the Murænæ helena?

25. What are the characters of the Gymnoti properly so called? What are the characters of the electric Eel? Where is it found? What are its habits?

violent electric shocks it has the power of communicating at will, and in the direction it pleases. This fish acquires five or six feet in length, (*Fig.* 58.); its body is elongated, and of the same size throughout, and its skin is imbued with a gluey matter: it is very common in the small rivulets and lakes, and met with here and there on the immense planes situate between the Cordillera, the Oronoco, and Banda-Oriental, and it is also found in the Apure, Oronoco, Meta, &c The electric shocks which it gives, are sufficiently powerful to knock down men and horses, and the Gymnotus resorts to this means of defending itself against its enemies, and to kill at a distance, fishes upon which it feeds; for water, as well as metals, transmits the benumbing shock of this singular animal, in the same manner that the lightning rod conducts the electricity of the clouds from the atmosphere to the earth. Its first discharges of electricity are generally feeble; but when it is irritated and agitated, they become more and more powerful, and are then terrible. When it has thus given repeated shocks, it becomes exhausted, and requires a greater or less period of rest before it regains its power. It is said, that it employs this time in charging its electric organs, and that the Americans avail themselves of this circumstance to capture it without danger. To catch the gymnoti, they drive into the pools inhabited by these fishes, wild horses, which, receiving the first shocks, are soon benumbed, and thrown down or even killed; then they obtain the exhausted gymnoti with nets, or a harpoon.

26. The electric apparatus of the gymnotus extends all along the back and tail, and consists of four longitudinal fasciculi, composed of a great number of membranous plates, which are parallel and very close together, and arranged almost horizontally and united by an infinity of other smaller lamellæ placed vertically crosswise: the little prismatic and transverse cells, formed by the junction of these lamenæ, are filled by a gelatinous matter: the whole apparatus is supplied with very large nerves.

ORDER OF LOPHOBRANCHII.

27. This order is distinguished by the branchiæ, which, in place of being pectinate, that is, having the form of comb-teeth, as is ordinarily the case, are divided into small round tufts, arranged in pairs along the branchial arches. They are enclosed under a large operculum, which is attached on all sides by a membrane, leaving only a small hole for the escape of water,

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26. What is the situation of the electric apparatus of the Gymnotus? What are the characters of this apparatus?

27. What are the characters of the order of Lophobranchii?

and in its thickness we find only vestiges of branchiostegous rays. These fishes are also recognised by the mail-like plates which cover the body, and render it almost always angular. They are generally small.

28. To this order belongs the *Hippocampus*, (*Fig.* 59.) the body of which is laterally compressed, and more elevated than the tail; on curling up, after death, the head and trunk bear some resemblance to the neck of a horse in miniature, which has obtained for this little fish the common name of *Sea-horse.*

Fig. 59.

HIPPOCAMPUS.

ORDER OF PLECTOGNATHI.

29. The fishes composing this group form the connecting link between the ordinary and cartilaginous fishes, as much by the conformation of their jaws, as by the tardy consolidation of their skeleton. Their chief distinctive character is, that the maxillary, is solidly fixed upon the side of the intermaxillary bone, which alone forms the jaw, and that the palatine arch articulates with the cranium, in a manner which renders it immoveable. Moreover, their opercula and branchiostegous rays are concealed beneath a thick skin, which leaves externally only a small branchial slit; they have no true ventral fins; and they have only vestiges of ribs. This order comprises two families, recognisable by the opening of their mouth, namely: the *Gymnodontes*, and the *Sclerodermi.*

30. In the Family of Gymnodontes, there are no apparent teeth; but the jaws are furnished with a species of ivory beak, internally divided into plates, which represent the teeth It includes the *Diodon*, the *Tetradon*, the *Mole*, &c.

31. The Diodon has received this name, because the jaws, being undivided, have each but a single piece, while in the Tetradon, they are divided in the middle by a suture, so as to present the appearance of four teeth: two above, and two below. These two genera of fishes have the faculty of swelling themselves up like a balloon, by swallowing air, and thus distending a first, very extensible stomach, which occupies the whole length of the abdomen. This peculiarity has obtained for them the

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28. What is the Hippocampus?

29. What are the characters of the order of Plectognathi?

30. How are Gymnodontes characterised?

31. How does the Diodon differ from the Tetradon? What are the peculiarities of these two genera?

common names of *Swell-Fish*, *Porcupine-Fish*, *Balloon-Fish*, *Blower*, &c., and furnishes them with a means of defence; for, when the skin is distended, the spines with which it is armed, become every where erect, and bristle the whole surface of the body; and when they are thus swelled, they turn over, the belly coming uppermost, and they float on the surface of the sea without the power of directing their course. They are found in the tropical seas, and on the North American coast.

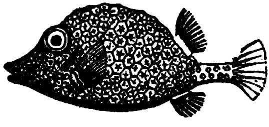
32. The SUN-FISHES, or MOLES,—*Cephalus*,—sometimes called *Moon-Fishes*, resemble the Diodon, in the arrangement of their jaws; but their body which is compressed, and of a strange shape, has no spines, nor is it susceptible of inflation; and their tail is so short and so high vertically, they appear like fishes having the posterior part cut off. One species, which sometimes attains more than four feet in length, weighing over three hundred pounds, inhabits the coast of France.

33. The FAMILY OF SCLERODERMI, is easily distinguished by the conical or pyramidal snout, prolonged from the eyes, and terminated by a small mouth, armed with a small number of distinct teeth. The skin is generally rough, or covered with hard scales.

34. Some of them, named BALISTES, have a compressed body covered by a scaly or granular skin, but not osseous: they have eight teeth, generally trenchant, arranged in a single row in each jaw, and two dorsal fins. They are found in great numbers in the torrid zone.

35. Others, called TRUNK-FISHES,—*Ostracion*,—have, in place of scales; (*Fig*. 60.) regular, bony compartments or plates, united into a kind of inflexible coat of mail, which covers the head and body, so that they can only move the tail, the fins, the mouth, and a kind of small lip, around the edge of their gills, which pass through holes in this cuirasse; each jaw is armed with ten or twelve conical teeth. They are found on the coast of the United States.

Fig. 60.



TRUNK FISH.

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32. How are Sun-fishes characterised?
33. How is the family of Sclerodermi distinguished?
34. How are the Balistes characterised?
35. What are the characters of Trunk fishes?

LESSON IX.

DIVISION OF CARTILAGINOUS FISHES, OR CHONDROPTERYGIANS.—*Organization.*
ORDER OF STURIONES.—*Sturgeons.—Caviar.—Fish-glue.*
ORDER OF SELACHII.—*Sharks.—Saw-fish.—Rays.—Torpedo.*
ORDER OF CYCLOSTOMI.—*Lampreys.*

DIVISION OF CHONDROPTERYGII, OR CARTILAGINOUS FISHES.

The Chondropterygians differ in many respects from all the fishes we have spoken of, and are less uniform in their structure. Some of them have organs even more complicated than the last, and approximate more to the reptiles, while others form a sort of connecting link, between the vertebrata and inferior classes of animals.

1. Their skeleton is essentially cartilaginous: it is not formed of bony fibres, and the calcareous matter that hardens on its surface, is only deposited in small grains. Sometimes the skeleton is only membranous, and it is always more simple in its conformation than that of the osseous fishes. It is also remarked, there is a resemblance between it and the cartilaginous skeleton of the tadpole. The cranium is not divided by sutures, and is composed of a single piece, shaped in other respects very much like the skull of an ordinary fish. The upper jaw is formed of pieces analogous to the palate bones and vomer; the maxillary and intermaxillary bones do not exist, or are found only in a rudimentary state, concealed beneath the skin. The lower jaw is constituted of one piece on each side, and the opercular apparatus is, in general, entirely wanting. The vertebral column is sometimes formed, in a great part, of a single tube, pierced on each side for the passage of nerves, but not divided into distinct vertebræ; frequently too, the bodies of the vertebræ are pierced through and through, so that the gelatinous substance, which fills the spaces betwixt these bones, forms a continuous cord. The disposition of the bones of the shoulder, of the pelvis, and fins, varies. The hyoid apparatus, which supports the branchiæ, is, in general, much the same as it is in ordinary fishes; but, towards the termination of this series or division, the branchial arches are wanting, and the branchiæ are only attached, on the

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1. What are the characters of the skeleton of cartilaginous fishes? Is there any thing peculiar in the arrangement of their branchiæ?

internal side, to the parietes of a membranous canal. Remarkable modifications in the mode of organization of these organs are observed. Sometimes the branchiæ are free on the external edge, as in the osseous fishes; sometimes, on the contrary, they are attached by both edges, and this difference furnishes a basis for the division of cartilaginous fishes into two groups: the *Chondropterygians with free branchiæ,* which constitute a single order, and the *Chondropterygians with fixed branchiæ,* which form two orders, the *Selachii,* and *Cyclostomi.*

ORDER OF CHONDROPTERYGII BRANCHIIS LIBERIS, OR STURIONES.

2. The Sturiones, or Chondropterygians with free branchiæ, of which the Sturgeon is the type, resemble ordinary fishes in the disposition of their gills, as well as in their free branchiæ; they have, on each side, a single branchial opening, furnished with an operculum, but which wants the rays.

3. The STURGEONS, — *Acipenser,* — have the general form of osseous fishes, and, in the structure of their skeleton, form the connecting link between them and the Chondropterygians; for many bones of their head and shoulders are completely hardened and, as it were stony on the surface. Their upper jaw is composed of the palate bones solidly attached to the maxillary bones, and vestiges of intermaxillary bones are found in the substance of the lips. The body is more or less covered with plates imbedded in the skin in longitudinal rows; their mouth is small and unprovided with teeth; the dorsal fin is situated behind the ventral, and above the anal fin; the caudal fin surrounds the extremity of the tail, and has a projecting lobe beneath. These fishes are generally large, and endowed with very considerable muscular strength: they easily stem the most rapid current, and can strike violent blows with their tail; but their habits are ordinarily peaceful, and they are formidable only to small, or badly armed fishes; they feed on herrings, mackerels, sometimes salmons, and they have been seen to root in the mud with their nose, in pursuit of worms and mollusks. In the spring they ascend certain rivers from the sea, often in numerous shoals, to deposit their eggs. Their fecundity is very great; we are assured that 1,500,000 eggs have been found in one female that weighed 278 pounds, and in another, weighing 2800 pounds, the eggs by themselves, weighed 800 pounds. The young ones

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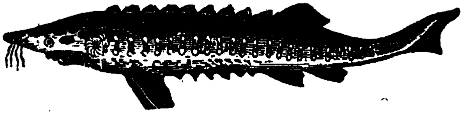
2. What are the characters of the Sturiones?

3. What are the characters of Sturgeons? What is Caviar? What is Ichthyocolla?

appear to seek the sea very early, and remain until full grown. The flesh of most of these fishes is agreeable, and there is prepared from their eggs a food, which is very much esteemed in the north of Europe, known under the name of *caviar;* and it is chiefly from their swimming-bladder that *fish-glue,* or *ichthyocolla* is prepared.

4. Many species of sturgeons are known; they are found in western Europe and North America; but it is particularly in the great rivers of the eastern part of Europe, and the north of Asia, that they abound, and give rise to important fisheries. The *Common Sturgeon,—Acipenser sturio,*—is six or seven feet long, with a pointed snout, and five rows of strong, spiny plates: it enters the large rivers of France about the month of April, and ascends in numerous shoals, the Danube, the Don, and many other streams that flow into the Caspian Sea. This species is found in the waters of the United States. The ***Hausen,*** or *Great Sturgeon,—Acipenser huso,*—(*Fig.* 61.) which attains from twelve to fifteen feet in length, and often weighs more than twelve hundred pounds, and sometimes even as much as three thousand is sometimes seen in the Po: but generally, it only frequents the Danube, the Don, the Volga, and other rivers which empty into the same seas. It enters them in shoals, from the end of winter, and, immediately after spawning, returns to the sea, where it is soon followed by its young. Its flesh is less esteemed than that of the common sturgeon; but it is chiefly from its eggs and its swimming-bladder that *caviar,* and *ichthyocolla* are prepared. It is distinguished from the last by its blunter tubercles or plates, its shorter snout, and smoother skin. The *Sterlet,* or *Little Sturgeon,—Acipenser pygmæus,*—which seldom exceeds two feet in length, and which has its plates arranged in more numerous rows than the preceding species, also inhabits the rivers which flow into the Black and Caspian Seas: its flesh is said to be delicate; it is probably the *elops* and *acipenser* so celebrated among the Romans.

Fig. 61.



THE GREAT STURGEON.

5. We give the name of *Polyodon,—Spatularia,*—to certain fishes of the Mississippi river, which bear some analogy to

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4. What are the characters of the common Sturgeon? What are the characters of the great Sturgeon? Where is it found? What is the Sterlet?

5. What is the Polyodon?

sturgeons: they are remarkable for an enormous prolongation of the muzzle, to which its wide borders give the figure of a leaf. The mouth is well cleft, and furnished with numerous small teeth.

6. The *Chimæras* form a connecting link between the preceding and the sharks, which they resemble in the general form of the body.

CHONDROPTERYGII BRANCHIIS FIXIS.

7. The Chondropterygians with fixed branchiæ, which form the two orders of Selachii and Cyclostomi, possess a very remarkable character in the arrangement of their respiratory apparatus, which is common to them all. Instead of having the branchiæ free on the external edge, and suspended in a common cavity, from which the water escapes by a single opening, they have them, on the contrary, adherent to the integuments, so that, for the escape of the water that laves them, there is required as many openings as there are intervals betwixt them; sometimes, however, they empty into a common canal, which serves to transmit the water externally; and their cartilaginous arches, often suspended in the flesh, are placed opposite to the external edges of the branchiæ. In other respects these fishes differ very much from each other, and are divided into two orders, according as they are provided with moveable jaws of the ordinary form, or according as these organs are solidly united into an immoveable ring, only suited for suction. The first are the *Selachii*, and the second the *Cyclostomi*.

ORDER OF SELACHII.

8. This order comprises the greatest number of cartilaginous fishes, Rays and Sharks, for example. Their external form varies; they have pectoral fins; ventral fins situate on the abdomen near the anus; five branchial openings in the form of slits, on each side of the neck, or on its inferior face, and the jaws are armed with teeth. In a great many of these fishes, there is on the upper surface of the head, two openings, called *vents*, or *spiracles*, which lead to the branchiæ, and serve to carry off the water, necessary to respiration, when the throat of the animal is

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6. What are Chimæras?

7. What are the characters of Chondropterygians with fixed branchiæ? What are the peculiarities of their branchiæ?

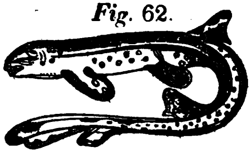
8. How is the order of Selachii characterised?

distended by a voluminous prey. Some of them are *ovo-viviparous*, and others lay eggs covered by a hard, horny shell. It is divided into *sharks*, *saw-fishes*, *rays*, &c.

9. The Sharks,—*Squalides*,—constitute a large tribe, recognisable by their general form, which differs but little from that of ordinary fishes. Their body is elongated, the tail stout and fleshy, and the pectoral fins of moderate size. Their eyes are situate as usual, on the sides of the head; their muzzle presents nothing remarkable, and the openings of their branchiæ are found upon the sides of the neck; the shoulder bones are suspended in the flesh, without articulating either with the cranium or vertebral column, and the skin is rough and their flesh coriaceous. Most of them attain a large size, and are very voracious.

10. The *Roussettes*,—*Scyllium*,—are distinguished from other Squali, by a short, obtuse snout, by the nostrils being pierced near the mouth, and surrounded by a groove which extends to the lip. These fishes are provided with spiracles and an anal fin; their dorsals are behind it, and the caudal is elongated, not forked and truncated at the end; their branchial openings are situate partly under the pectorals. There are two large species on the coast of France, the *Great Roussette*, or *Sea-Dog*,—*Squalus canicula*,—(*Fig.* 62.) which is also found on the American coast, attains three or four feet in length, and the *Rock-Shark*,—*Squalus catulus*. The skin of these fishes, which is studded with a multitude of small, stony tubercles, becomes very rough on drying, and is then employed in the arts for polishing hard bodies, such as ivory.

Fig. 62.



SEA-DOG.

11. Sharks properly so called have the nostrils without a groove, and situate under the muzzle, which is prominent. The caudal fin is more or less forked. Some of them have spiracles, and in others they are wanting.

12. The genus *Carcharias*, have no spiracles, and are provided with an anal fin; their muzzle is depressed and the mouth is strongly armed with pointed, trenchant teeth, which are generally dentate on the edges.

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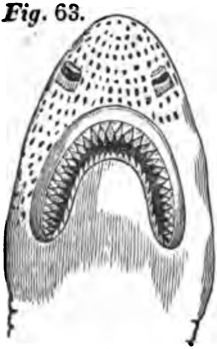
9. What are the characters of Sharks?
10. How are Roussettes distinguished from other Sharks?
11. How are Sharks properly so called characterised?
12. What are the characters of the genus Carcharias?

13. The *White Shark,—Squalus carcharias,*—which attains twenty five or thirty feet in length, is celebrated for its ferocity. Its vast mouth, (*Fig.* 63.) is furnished with triangular, moveable teeth, the number of which increases with age. In the young, we see but a single row; but, in the adult, we find six. The strength of this fish is very great, and its motions rapid; its voracity knows no bounds; hence, it is among the most dangerous animals. Men frequently become the prey of sharks, and as many as eight or ten tunnies have been sometimes found in its belly. Seals, tunnies, and cods, are their ordinary food; but they attack dead bodies, and even devour each other. It appears they are found in every sea; but voyagers often confound with the carcharias, other species of sharks with cutting teeth.

Fig. 63.



SHARK'S HEAD.

14. The Saw-Fishes,—*Pristis,*—unite to the form of the sharks, a body flattened in front, with branchial openings beneath, as in the Rays, but they are especially distinguished by a very long snout, depressed in form of a sword-blade, armed on each side with strong bony spines, which are pointed and trenchant This beak, from which they derive their name, is a powerful weapon, with which they do not fear to attack the largest whales. The true teeth of their jaws are like small pebbles, (*Fig.* 47, *Page* 94.)

15. The *Common Saw-fish,—Squalus pristis,*—which is found in almost every sea, attains a length of twelve or fifteen feet. Its skin is tuberculous, of a very dark gray on the back, ash-colour on the sides, and whitish under the belly.

16. The Rays,—*Raia,*—form a large tribe. Fishes of this genus are recognised by their body being horizontally flattened, and similar to a disk, a conformation which is principally due to the disposition of their pectoral fins, which are extremely broad and fleshy, and are joined to each other in front or to the muzzle, and extend backwards on both sides of the abdomen, nearly to the base of the ventral fins; the eyes as well as the spiracles are placed on the dorsal face: the mouth, the nostrils, and the openings of the branchiæ are on the ventral surface of the body; and

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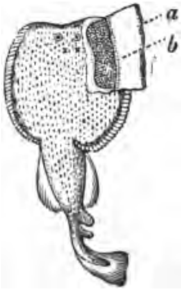
13. What are the characters of the White Shark?
14. How are Saw-fishes distinguished?
15. What are the characters of the common Saw-fish?
16. How is the genus of Rays recognised?

the dorsal fins are almost always upon the tail, which is very slender. This group is divided into *Rays properly so called*, *Torpedoes*, &c.

17. The *Rays properly so called*,—*Raia*,—have the body of a rhomboidal form, a slender tail, fine teeth, &c. Our coast furnishes many species, such as the *Skate*, *Stiny-Ray*, &c.

18. The Torpedoes, or Electric Rays,—*Torpedo*,—have a short, but fleshy tail. The body is smooth and in form of a nearly circular disk, the anterior border of which is formed by two prolongations of the snout, which, on each side go to join the pectoral fins, and leave between these organs, and the head and branchiæ, an oval space (*Fig.* 64.) in which is lodged the electric apparatus of these fishes. This apparatus consists of a multitude of vertical, membranous tubes, placed close together like the cells of a honey-comb, subdivided by horizontal partitions into small cells filled with mucus, and supplied by numerous large branches of the pneumogastric nerve. In these singular organs is produced the electricity, by aid of which torpedoes communicate electric shocks to those who touch them, a faculty possessed by the malapteruri, (*Page* 103.) and gymnoti, (*Page* 115.) but which, in these last, is seated in a different structure. These fishes are less powerful than the gymnoti, but can nevertheless, benumb the arm of a person touching one of them, and they probably resort to this means to obtain their prey. Several species are found on the coasts of France.

Fig. 64.



TORPEDO.

ORDER OF CYCLOSTOMI.

19. This last order of cartilaginous fishes is characterised by the singular conformation of the mouth, and is composed of the most imperfectly organised of all the vertebrate animals.

20. Their body, elongated, naked and viscid, is unprovided with thoracic and abdominal extremities; for both the pectoral

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**Explanation of Fig.* 64.—The Torpedo, or Electric Ray:—*a.* a portion of the skin detached to show one of the electric organs, (*b.*)

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17. What are the characters of Rays properly so called?

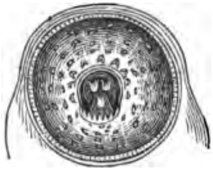
18. How are the Torpedoes characterised? What is the nature of their electric apparatus?

19. How is the order of Cyclostomi characterised?

20. What are the characters of fishes of this order? What are the peculiarities of their respiratory apparatus?

and ventral fins are wanting. Anteriorly, they terminate in a circular, or semi-circular, fleshy lip, sustained by a cartilaginous ring, formed by the solid union of the palatine and lower jaw bones, or rather, cartilages. The vertebræ are reduced to simple cartilaginous rings, scarcely distinct one from the other, traversed by a tendinous cord, and surmounted by a second ring which is more solid, surrounding the spinal marrow. There are no true ribs nor branchial arches; the branchiæ, instead of being pectinate, present the appearance of sacks formed by the union of the face of one branchia, with that of a corresponding branchia on the opposite side. Sometimes this imperfect skeleton is not even cartilaginous, but always remains membranous. The organs of the senses are less complicated in structure than they are in ordinary fishes. They have no swimming-bladder.

Fig. 65.



MOUTH OF A LAMPREY.

21. The LAMPREYS,—*Petromyzon*,—are recognised by seven branchial openings which are seen on both sides of the neck, by their circular labial ring, armed with several ranges of strong teeth, and horny tubercles, (*Fig.* 65.); the tongue is also furnished with teeth, and is carried forward and backward like a piston, which enables the animal to exert the faculty of suction and use its buccal disk, not only to suck up the juices upon which it feeds, but to attach itself to solid bodies. The skin of these fishes is raised up above and beneath the tail in a longitudinal crest that takes the place of fins, which are sustained only by vestiges of fin-rays. The water necessary for respiration passes from the mouth to the branchiæ, by a canal situate under the œsophagus, and pierced laterally by holes.

Fig. 66.

SEA LAMPREY.

22. The *Sea Lamprey*,—*Petromyzon marinus*,—(*Fig.* 66.) which is two or three feet long, and marbled brown on a yellowish ground, inhabits the coasts of France, and the United States, and in the spring ascends rivers to deposit its eggs. It ordinarily preys on marine worms, and small fishes, or fragments of dead bodies; but it attaches itself to large fishes, and succeeds in piercing their skin and devouring them. Its

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21. What are the characters of the Lampreys? What is the structure of their mouth?

22. What are the characters of the Sea Lampreys? What are their habits? What are the characters of fresh water Lampreys? Where are Lampreys found?

flesh is much esteemed. The *Fresh Water*, or *River Lamprey*, —*Petromyzon fluviatilis*,—is a smaller species, seldom exceeding eighteen inches in length, and passes the greater part of the year in fresh water lakes, which it abandons in the spring to enter rivers. Its colour is dark olive above, and yellowish or silvery beneath. It is found in the fresh waters of New England. A third species is the small River Lamprey, eight or ten inches in length; it also inhabits fresh waters, and is distinguished from the preceding by its dorsal fins, which are continuous or united, instead of being distinct.

23. The *Hag-fishes*,—*Myxine*—have the maxillary ring entirely membranous, and armed above by a single fang-like tooth, or they are entirely destitute of teeth, while the tongue is armed on each side with two horny plates deeply serrated, so that, at first sight, they might be supposed to have lateral jaws, like articulated animals with which in fact, some authors have placed them; in other respects their organization is analogous to that of lampreys. Their body is cylindrical, and furnished posteriorly with a fin which surrounds the tail; their mouth is circular, surrounded by eight cirri, and its upper margin is pierced by a spiracle which communicates with its interior. They have no vestiges of eyes, and their body is lubricated by a great quantity of mucus. Thus provided, the Myxine, when it attacks its prey, uses its mouth like a cupping-glass, and plunges its fang into its flesh; and, thus securing a firm hold, the lingual saws tear their way into its very vitals. Some, called *Heptatremus*, have seven branchial apertures on each side of the neck; others, named *Gastrobranchus*, have on each side, a canal, which receives, through particular holes, the water coming from the branchiæ, and empties externally by a hole situated at about one third of the length of the body; and in others again, the branchial openings are arranged as in the lamprey and heptatremus; but the fleshy lip, which is unprovided with teeth, is only semi-circular, and covers only the upper part of the mouth which prevents them from using it as a means of attaching themselves. These last myxines, which are named *Ammocetes*, have an entirely soft and membranous skeleton; they keep in the mud of small streams, and have many of the habits of worms, which they resemble also in form.

It may be well for the reader, who has followed us through our first, second, third, and fourth books, to remark that we began our account of the animal world, with a general description of the most perfectly organized being, and we found man, independently of his possessing an immortal soul, the most complete,

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23. What are the characters of the Myxines?

and most wonderful of all animal structures. Without any other reason, he is placed at the head of the great class of mammals; and it may be observed, as we advanced in our descriptions, that the animals became less and less perfectly organised: the nervous system, the respiratory and circulatory systems grow less and less perfect as we proceed. On reaching the reptiles, we discover, for example, that their heart has lost one ventricle, and their blood is cold; and in fishes, we find it has also lost an auricle, and consists only of a single auricle, and a single ventricle. In the fishes too, we observe striking changes in the composition of bone; and the skeleton gradually loses its hardness, until we come to the Myxines, where it is soft and membranous; or, it might be said, the internal hard frame called the skeleton, has disappeared, and we are brought step by step, to the consideration of soft animals without vertebræ; but, nevertheless, they are provided with organs suitable for maintaining the kind of life with which they are endowed by the Omniscient Creator of all things.

This concludes our account of the vertebrate animals, which constitute the FIRST BRANCH of the Animal Kingdom. We have next to consider the SECOND BRANCH, composed exclusively of the Molluscous Animals, the study of which embraces Conchology, or the History of Shells.

END OF THE FOURTH BOOK OF NATURAL HISTORY

GLOSSARY.

HERPETOLOGY AND ICHTHYOLOGY.

ABDOMEN.—From the Latin, *abdere*, to conceal. The belly. The chief viscera contained in the abdomen are the stomach, intestines, liver, &c. &c.

ABDOM'INAL.—Relating or belonging to the abdomen.

ABDOMINA'LES.—Latin. Plural of *abdominalis*. Relating to the abdomen. Applied to an order of fishes, which have the ventral fins placed beneath the abdomen. (See p. 99.)

ABOMA.—Systematic name of a species of Boa, (Page 57.)

ABRAMIS.—The generic name of the Breams.

ABSORP'TION.—From the Latin *absorbere*, to drink, to suck up. The function of absorbent vessels, by virtue of which they take up substances from without or within the body.

ACANTHOPTERY'GIAN.–From the Greek *akantha*, a spine, and *pteron*, wing. Applied to fishes that have bony fin-rays.

ACANTHOPTERY'GII.—Latin. Plural of *acanthopterygius*. Same derivation. Name of the first order of the class of fishes, given to them because they have bony fins.

ACANTHU'RI—Latin. Plural of *acanthu'rus*. From the Greek, *akantha*, a spine, and *oura*, tail. Generic name of a kind of fishes vulgarly called Surgeon, because they have sharp, lancet-like spines on the tail. (Page 58.)

ACI'PENSER—Latin. A Sturgeon.

ACUTUS.—Latin. Sharp-pointed.—Acute.

ADI'POSE—From the Latin, *adeps*, fat. Belonging or relating to fat.

ÆGYPTIA'CUS.—Latin. Egyptian. Belonging to Egypt.

AGA'MIAN.—From the Greek *a*, privative, and *gamos*, marriage. Having no sex. Applied to certain Lizards.

ALO'SA.—Generic name of the Shad.

ALVE'OLI.—Latin. Plural of alveolus. Sockets of the teeth.

ALVE'OLUS. — Latin. The hole in which a tooth is placed.

AMMOCETES.—From the Greek *ammos*, sand. Name of a genus of fishes that live in the sand or mud, (See page 127.)

AMPHIB'IOUS.—From the Greek *amphi*, double, and *bios*, life. That which partakes of two natures, so as to live in two elements; as in the air and water.

AMPHISBÆNA.—From the Greek, *amphis*, both, and *bainein*, to move, to walk. Walking both ways. The Generic name of a serpent.

AMPHI'UMA.—Generic name of a kind of Salamander.

ANA'BAS.—From the Greek, *anabainô*, I ascend, I embark. Generic name of a kind of fishes that crawl on the land, and live for a time out of water. (Page. 95.)

A'NAL.—Belonging or relating to the anus. The *anal fin* obtains its name from being near the anus.

ANA'LOGOUS.—From the Greek, *ana*, between, and *logos*, reason. Having some resemblance or relation, though differing in essential particulars. Similar.

ANASTOMO'SIS.—From the Greek, *ana*, between, and *stoma*, mouth. The communication between two vessels or nerves.

Anastomo'se.—Vessels or nerves that communicate with each other are said to anastomose.

Anchylosed,—an-ky-los'-ed. From the Greek, *agkule*, stiff-joint. A joint or articulation which has become immoveable is said to be anchylosed.

Anguilla.—Latin. An eel.

Anguilliformes.—From the Latin. *anguilla*, eel, and *forma*, shape. Eel-shaped. Systematic name of a tribe of fishes which are eel-shaped.

Angui'na. — Latin. Formed from *anguis*, a serpent. Systematic name of a family of ophidians.

Angui'nus.—Latin. Belonging or relating to serpents.

Anguis.—Latin. A snake.

Ano'lis.—A kind of saurian, called *anoli*, in the Antilles.

Ano'lius.—Latin. Generic name of the Anolis.

Anou'ra.—From the Greek, *a*, or *an*, privative, and *oura*, tail. Without a tail. The systematic name of a family of Batrachians.

Ante-oper'culum.—A part of the gill-cover, or operculum, which is before the operculum proper. (See Page 79.)

Antepenultimate.—From the Latin, *ante*, before, *pene*, almost, and *ultimus*, the last. That which is immediately before the next to the last; or, that which is immediately before the penultimate.

A'nus.—Latin. The fundament: the inferior opening of the bowels.

A'orta.—From the Greek, *aorte*, a vessel. The great primary artery which conveys blood to all parts of the body.

Apo'da.—From the Greek *a*, privative, and *pous*, (in the genitive *podos*,) foot. Footless; without feet.

Apo'des.—Latin.—Same derivation as apoda. Applied to an order of fishes.

Apodous.—Same derivation as apoda. Without feet.

Appara'tus.—From the Latin, *ad*, for, and *parare*, to prepare. A collection of instruments or organs for any purpose whatever. An assemblage of organs.

Arbore'a.—Latin. Belonging or relating to a tree; branched like a tree.

Arches of the branchiæ.—A system of small bones joined together by ligaments, which supports a series of pectiniform vascular fringes, constituting the gills of fishes. The *branchial arches*, which are generally four in number on each side, are attached by one extremity to an intermediate chain of bones, situated in the middle line behind the hyoid bone, while by their opposite extremity they are connected by ligaments to the under surface of the cranium. They are perfectly flexible, and so arranged as to prevent food taken into the mouth, from being forced out through the branchial fissures with the issuing streams of water; so that in reality, these pieces fulfil in their way, the same office as the epiglottis of mammals.

Arm'ature.—Armour. The armatute of the mouth consists of the teeth, &c.

Arter'ial.—Belonging or relating to arteries.

Arterial'ised. — When venous or dark blood, by the process of respiration, is converted into arterial blood, is it said to be arterialised.

Arte'ry.—From the Greek, *aer*, air, and *terein*, to preserve, because, it was anciently believed that the arteries were filled with air like the windpipe. The vessels which convey blood from the heart to all parts of the body, are called arteries.

Articular surface.—The surface of that part of a bone which forms an articulation or joint.

Artic'ulate.—From the Latin *articulus*, which is the diminutive of *artus*, a limb, which is derived from *arthron*, a joint. To join or joint with. Also, to form words, to utter.

Articulation.—A joint.

Asphyx'ia.—From the Greek, *a*, privative, and *sphuxis*, pulse. Without pulse. Suspended animation.

Asphyx'iate.—In a state or condition of suspended animation.

At'rophied.—From the Greek *a*, privative, and *trophe*, nourishment: without nourishment. Wasted: when the whole bulk of the body is progressively and morbidly diminished, or wasted, it is said to be atrophied, or in a state of atrophy.

Atrona'sus.—Specific name of the Minnow.

Aura'tus.—Latin. Golden.

Aur'icle.—From the Latin, *auricula*, which is the diminutive of *auris*, ear. A part of the heart is so called from its resemblance to an ear. Also applied to a part of the ear.

Ax'olotus.—Latin. Generic name of the axolotls.

Axolo'tl.—Mexican. Name of a kind of batrachian.

Balis'tes.—Systematic name of certain fishes of the family of Sclerodermi, given to them by Artedi, from their Italian appellation, *Pesce balestra*, (Cross-bow-fish,) which is derived from a supposed similitude between the motion of their great dorsal spine, and that of a cross-bow.

Barba'tus.—Latin. Bearded; having a beard.

Barb'us.—The generic name of the Barbels.

Basilis'cus.—Latin. A basilisk; a kind of saurian.

Batrach'ia.—Ba-trak'e-a. Latin. (Plural.) Batrachians.

Batrach'ian.—Ba-trak'-e-an. From the Greek, *batrachos*, frog. A name given to those reptiles which resemble frogs in their mode of organization.

Belo'ne.—Be-lo'-ne. From the Greek *belone*, point of an arrow; a kind of fish. Specific name of the Sea-pike.

Be'rus.—Specific name of the common viper, given by Linnæus. This name was only used by authors of the middle century.

Bi'fid.—From the Latin, *bis*, twice, and *findere*, to split. Split or divided into two separate parts.

Bi'furcate.—From the Latin, *bis*, twice, and *furca*, fork. To divide or separate into two branches. Divided or separated into two branches.

Bi'mana.—Latin; formed from *bis*, two, and *manus*, hand. Having two hands. Systematic name of a kind of saurian that has anterior extremities only.

Bi'pedes.—Bi'-pe-des. Latin, plural; formed from *bis*, two, and *pes*, foot. Having two feet. Applied to Saurians that have abdominal extremities alone.

Brach'ial.—Brak-'e-al. From the Latin, *brachium*, an arm. Belonging or relating to the arm.

Bra'ma.—Systematic name of the Castagno'es.

Branch'iæ.—Brank'-e-æ. Latin, plural of branchia. From the Greek, *bragchos*, throat. The gills of fishes.

Branch'ial.—Brank'-e-al. Belonging or relating to the branchiæ. *Branchial arches*, see, Arches of the Branchiæ. *Branchial openings*, apertures for the passage of water from the gills.

Branchi'fera.—Brank'-i-fe-ra. From the Latin, *branchiæ*, gills, and *fero*, I bear. Gill-bearing. Systematic name of a family of batrachians.

Branchiis.—Brank'-e-is. Latin, plural, (ablative.) *Branchiis liberis*, with free branchiæ. *Branchiis fixis*, with fixed branchiæ.

Branchioste'gous.—Brank.i.oste'gous. From the Greek, *bragchia*, the branchiæ or gills, and *stegô*, I cover. Belonging or relating to the gill-cover. The great fissure that exists on each side between the head and shoulder of an osseous fish, wherein the gills are situated, is not closed merely by the opercular bones, but likewise by a broad membranous expansion, called the *Branchiostegous membrane*, which is adherent to the hyoid bone, and assists in forming the great valve of the operculum. This membrane is supported by a series of slender bones, derived from the external margin of each branch of the hyoid bone, and these are named from their office, the *Branchiostegous Rays.*

Buc'cæ.—Buk-say. Latin, plural of *bucca*, cheek. *Buccæ loricatæ*, mailed-cheeks.

Buc'cal.—Buk'-kal. From the Latin, *bucca*, cheek. Belonging or relating to the cheek.

Bu'fo.—Latin. A toad.

Bunga'rus.—Barbarous Latin. The generic name of the Rock-snakes.

Cæ'cilia. — Latin. Formed from *cæcus*, blind. Systematic name of a kind of batrachian, which has very small eyes, and sometimes none.

Caima'n.—Spanish. Alligator.

Calca'reous.—From the Latin, *calx*, lime. Containing, or partaking of the nature of lime.

Canic'ula.—Latin. A dog-fish.

Cap'illary.—From the Latin, *capillus*, a hair. Small, hair-like. The *capillary vessels*, are the extremely minute terminations of the arteries, and commencing branches of the veins.

Carap'ax.—The systematic name of the upper shell of tortoises.

Carbon'ic A'cid. — This is a gas which neither supports combustion nor respiration. It constitutes an essential ingredient in effervescing drinks, such as those known under the name of soda-water, mineral water, &c.

Carchar'ias.—From the Greek, *carcharos*, rude, snappish, wicked. The systematic name of certain sharks.

Cari'na.—Latin. The keel or bottom part of a ship. A sort of ridge or elevation.

Cari'næ.—Latin. Plural of carina.

Cari'nate.—Marked with a carina or ridge.

Carni'vorous.—From the Latin *caro*, (in the genitive, *carnis*,) flesh, and *voro*, I eat. Flesh eating; applied to animals that feed on flesh.

Ca'rotid.—The great arterial trunks, which convey blood to the head are called carotid arteries.

Car'pio.—Specific name of the common carp.

Car'pus.—From the Greek, *karpos*, the wrist. That part which is between the fore arm and hand.

Car'tilage.—Gristle. A solid part of the animal body of medium consistence between bone and ligament.

Cartilaginous. — Partaking of the nature of cartilage.

Cat'alepsy.—From the Greek, *katalepsis*, detention, which is formed from *katalambanô*, I arrest, I hold; because every kind of motion is arrested in *catalepsy*. A stupifying disease which suddenly seizes an individual, causing him to remain in the situation in which he was, at the moment of attack, and imparting to the limbs the power of retaining any position that may be given to them, and depriving him completely of sensation and voluntary motion, during the paroxyism.

Ca'tulus.—Latin. Properly, a whelp, a young dog. Specific name of a shark.

Cau'dal.—From the Latin, *cauda*, tail. Belonging or relating to the tail. The *caudal fin*, generally increases the length of the tail.

Cau'stic.—From the Greek, *kaiô*, I burn. Articles which have the property of burning or disorganising animal substances, such as pure potash, nitrate of silver, &c are called caustics.

Cau'terise.—The same derivation as caustic. To burn with a cautery or red hot iron. To apply caustic.

Cave'rnous.—Filled with small cavities or caverns, as a sponge.

Cavi'ar, or Caviare. — A culinary preparation, much used by certain people, and made on the shores of the Black and Caspian Seas, from the roe or eggs of the sturgeon, mixed with salt and other condiments.

Cel'lular.—Composed of cells.

Centrônotus.—Systematic name o the pilot-fish.

Cephalus. — ke'-fa-lus. From the Greek, *kephale*, head. Systematic name of the sun-fishes, given to them for their appearance of having the posterior part of the body cut off.

Cerastes.—From the Greek, *keras*, a horn. Specific name of the horned viper.

Cer'vical.—From the Latin, *cervix*, the neck. Belonging or relating to the neck.

Chœtodon.—From the Greek, *cheô*, I contain, and *odontos*, (genitive of *odous*,) a tooth. Generic name of certain fishes of the family of Squamipennes.

Chalcides.—From the Greek, *chalkis*, a serpent with a head resembling that of lizards. Generic name of a kind of saurian.

Chamæ'leo.—kam'-e-leo. From the Greek, *chamai*, earth, and *leôn*, lion: (because it pursues flies, as the lion does other animals.) Systematic name of the chameleons.

Chamæle'onidæ.—From the Greek, *chamaileôn*, chameleon, and *eidos*, resemblance. Systematic name of animals that resemble chameleons.

Che'lonia.—From the Greek, *chelône*, a sea-tortoise. Systematic name of the order which includes the tortoises.

Cher'sæa.—Specific name of a viper.

Chimæ'ra.—ky-me'-ra. A kind of fish, so called, from the fantastic figure it assumes when carelessly dried.

Chondropter'ygian. — kon-drop-ter'-igian. From the Greek, *chondros*, cartilage, and *pterux*, (in the genitive, *pterugos*,) fin or wing. Systematic name of fishes with a cartilaginous skeleton.

Chondropterygii. kon-drop-ter'-i-ge-i. Latin. Plural of *chondropterygius*. Chondropterygians. *Chondropterygii branchiis fixis*, chondropterygians with fixed branchiæ. *Chondropterygii branchiis liberis*, chondropterygians with free branchiæ.

Chyle.—kile. From the Greek *chulos*, nutritious juice. A nutritive fluid which is extracted from food by the action of the digestive organs.

Chryso'phris.—kris-o'-fris. From the Greek, *chrusos*, gold, and *ophrus*, eye-brow. Golden eye-brow. Systematic name of the daurade, given to it on account of a crescent-shaped band of golden hue, which extends from one eye to the other.

Cirri.—Latin. Plural of cirrus.

Cirrus.—Latin. A tuft, a beard, a fringe. Applied to that which hangs in form of mustache, or beard, from the end and sides of the mouth of certain fishes.

Ci'stude.—From the Greek, *kiste*, a chest, a coffer. Name of a kind of tortoise. The box tortoise.

Cla'vicle.—From the Latin, *clavis*, key. The collar-bone, so called from its resemblance to a key.

Clo'aca.—Latin. A common sewer. From the Greek, *kluzô*, I wash. The pouch at the extremity of the intestinal canal, in which the solid and liquid excretions are commingled in birds, fishes, and reptiles.

Clupea.—Latin. A shad.

Clupeæ.—Latin. Plural of Clupea.

Cobitis.—Generic name of certain fishes. From the Greek, *kôbitis*, the name of an unknown fish.

Co'bra cap'ello—Portuguese. *Cobra*, snake; *capello*, a cawl, a hood: hood-snake. Name of a venomous serpent.

Cœca, or Cæca.—Latin. Plural of cœcum.

Cœcal.—Belonging or relating to the cœcum.

Cœcum.—From the Latin, *cœcus*, blind. The *blind gut*, so called from its being perforated or open at one end only.

Colon.—A portion of the large intestine.

Coluber.—Latin. Name of a serpent.

Conchology.—kon-kol'-o-gy. From the Greek, *kogchulion*, a shell, and *logos*, a discourse. A treatise on shells.

Condyle.—From the Greek, *kondulos*, a knot, an eminence, a bump. A small round eminence of bone entering into the composition of an articulation.

Coracoid.—From the Greek, *korax*, a crow, and *eidos*, resemblance. Resembling the beak of a crow. Name of a thick, short, process of bone, situate at the anterior upper part of the scapula in man. In birds and reptiles this process is represented by a separate bone.

Cordiform.—From the Latin, *cor*, (in the genitive, *cordis*) heart, and *forma*, shape. Heart-shaped.

Coria'ceous.—From the Latin, *coriaceus*, consisting of leather.—Leathery. Formed of leather.

Corpuscule.—A small body, a particle of matter, an atom.

Corselet.—A light armour for the front part of the body.

Cra'nial.—Belonging or relating to the cranium.

Cra'nium.—Latin. The skull.

Crocodilian.—Of the family of crocodiles.

Crocodi'lida.—From the Greek, *krokodeilos*, crocodile, and *eidos*, resemblance. Systematic name of the family of crocodiles.

Crocodi'lus.—Latin. A crocodile. According to some, from the Greek, *krokos*, saffron, and *deilos*, fearful, timid, because the land crocodile is afraid of the sight and odour of saffron; according to others, from *kroke*, shore, and *deilos*, timid, because the water crocodiles fear the shore, where men set snares for them.

Cro'talus.—Latin. Formed from the Greek, *krotaleô*, I make a noise. Rattle snake.

Crysoleucas.—Specific name of the Shiner.

Cuta'neous.—From the Latin, *cutis*, skin. Belonging or relating to the skin.

Cyclo'stomi.—Latin. Plural of *Cyclostomus*. From the Greek, *kuklos*, circle, and *stoma*, mouth. Systematic name of an order of fishes.

Cyprinoi'des.—From the Greek, *kuprinos*, a carp, and *eidos*, resemblance. Systematic name of a family of fishes.

Cyprinidæ.—Same derivation as cyprinoides; and applied in the same way.

Cyprinus.—Latin. A carp.

Dactylop'terus.—Dak-te-lop'-te-rus. From the Greek, *daktulos*, finger, and *pteron*, wing. Wing-fingered. Systematic name of the true flying-fishes.

Daurade.—French. Name of a fish.

Degluti'tion.—From the Latin, *deglutire*, to swallow. The act by which substances are passed from the mouth into the stomach, through the pharynx and œsophagus.

Den'tate.—From the Latin, *dens*, a tooth. Notched or toothed.

Dia'phragm.—Di'-a-fram. From the Greek, *diaphragma*, a partition. A fleshy or muscular partition, between the cavity of the chest and cavity of the abdomen.

Diodon.—From the Greek, *dis*, twice, and *odous*, (in the genitive, *odontos*) tooth. Systematic name of a genus of fishes which have but two teeth.

Discoboli.—Latin. Plural of discobolus, formed from the Greek, *diskos*, a disk, and *ballô*, I throw. A quoit-player. Systematic name of a family of fishes whose ventral fins form a disk.

Dorsal.—From the Latin, *dorsum*, the back. Belonging or relating to the back.

Duct.—A canal, pipe, or conduit.

Doctor.—Latin. A leader.

Eche'neis.—E-ke'-nice. From the Greek, *echô*, I hold, I stop, and *naus*, ship: a ship-holder, an anchor. Systematic name of a family of fishes, which the ancients supposed were capable of arresting the course of a vessel under sail.

Elaps.—From the Greek, *elaps*, or *elops*, a particular serpent. Systematic name of certain vipers.

Elec'tric.—Belonging or relating to electricity.

Electric'ity. — From the Greek, *elektron*, amber, the substance in which this imponderable cause of certain phenomena, was first observed. The property which certain bodies, such as glass, wax, sulphur, &c., acquire, by being rubbed, of attracting or repelling each other. In a more modern and extended signification, the power and action of a peculiar, imponderable fluid, the accumulation of which is manifested by sparks, and by communicating to the nervous system more or less powerful sensations, and producing effects analogous, if not identical with those of lightning.

Electcri'cus.—Latin. Electric. Possessing electricity.

Elevator.-Applied to muscles whose function is to raise certain parts.

Elops.—Specific name of a fish.

Enceph'alon.—En-kef'-a-lon. From the Greek, *en*, in, and *kephale*, head. The contents of the cranium: the brain and spinal marrow are generally included in this term.

Encrasicho'lus. — En-cra-si-ko'-lus. Specific name of the anchovy.

Engrau'lis.—Generic name of the anchovy.

Eperla'nus.—Systematic name of the smelt.

Epider'mic.—Belonging or relating to the epidermis.

Epider'mis.—From the Greek, *epi*, upon, and *derma*, skin. The scarf-skin; the cuticle.

Erix.—Generic name of a serpent.

E'soces.—Latin. Plural of esox.

Esox.—Latin. Generic name of the Pike.

Excretory.—An *excretory vessel*, or *duct*, is one which transmits the fluid, secreted by a gland, either externally, or into the reservoirs, in which it has to be deposited.

Ex'ocetus.—Latin. Generic name of a kind of flying-fish.

Extensile. — Susceptible of being stretched out or extended.

Extremities.—The limbs; the legs, arms, wings, fins, &c.

Facette'.—French. The diminutive of *face*. A small face: the *articular facette of a bone*, is a small circumscribed portion of its surface.

Fario.—Specific name of the common trout.

Fascic'uli.—Latin. Plural of *fasciculus*.

Fascic'ulus.—Latin. A little bundle.

Fe'mur.—Latin. The thigh bone.

Fibro-cartila'ginous.—Of the nature of fibrous tissue and cartilage.

Fibula.—The name of the long, slender bone, situate at the outer part of the leg.

Fil'ament.—From the Latin, *filamentum*, which is the diminutive of *filum*, a thread. A very small fibre.

Fi'liform.—From the Latin, *filum*, a thread, and *forma*, form, shape. Thread-like.

Fin.—The limb of a fish by aid of which it balances itself, and directs its course.

Fin-rays—The rays or spines which serve to sustain and spread the fins.

Fixis. — Latin. (Ablative plural.) Fixed.

Flesus.—The specific name of the Flounder.

Fluviati'le.—Belonging or relating to a river.

Fluviati'lis.—Latin. Fluviatile.

Formation.—Any group of rocks, or mineral substances, of similar character and age, is termed a formation in geology.

Fossa.—Latin. From *fodio*, I dig. A cavity of greater or less depth, the entrance to which is always larger than the base or bottom.

Fossæ,—Latin. Plural of *fossa*. The *nasal fossæ*, are two large, irregular cavities, situate between the orbits below the cranium, and behind the nose. The nostrils. The *temporal fossæ*, are the depressions of the temples on the sides of the cranium, towards its anterior upper part.

Fossette′. — Fos-sett. French. A little fossa; a pit, a dimple.

Fossil.—An organised body, found buried in the layers or strata of the earth, from a date, the antiquity of which we can form no certain estimate; most fossils appear to belong to periods even anterior to the existence of the human race.

Fra′gilis.—Latin. Fragile; easily broken.

Fusiform. From the Latin, *fusus*, a spindle, and *forma*, shape. Spindle shaped.

Gado′ides.—From the Greek, *gadus*, a certain fish, and *eidos*, resemblance. Systematic name of a family of fishes.

Gadus.—Generic name of the codfish.

Gange′tica.—Latin. Belonging or relating to the Ganges.

Gastrobranchus.— Gas-tro-brank-us. From the Greek, *gaster*, belly, and *bragchia*, gills. Systematic name of a genus of cartilaginous fishes; because the *openings of their gills are situate under the belly.*

Gecko.—Name given to a species of saurian of India, in imitation of its cry.

Geckotida.—From *gecko*, and the Greek *eidos*, resemblance. Systematic name of a family of saurians.

Geckotian.—Applied to animals of the family of geckotida.

Gelati′nous—Partaking of the nature of gelatine or jelly.

Genus.—Latin. A kindred, breed, race, stock, lineage, or family.

Ge′nera.—Latin. Plural of genus.

Gene′ric.—Belonging or relating to genus.

Geology.—From the Greek, *ge*, the earth, and *logos*, discourse. The study or description of the structure of the earth, and the changes which have taken place in it.

Gladius.—Latin. A sword. Systematic name of a sword-fish.

Gland.—From the Latin, *glans*, (in the genitive, *glandis*,) an acorn. A simple, soft, friable, spongy part of the body, which bears some resemblance to an acorn. Applied to those softish, granular organs, composed of numerous vessels, nerves, and a peculiar structure, which form peculiar secretions.

Gland′ular.—Composed of glands; resembling a gland.

Gobio.—Generic name of the Gudgeon.

Græca.—Latin. Greek; Grecian.

Gymnodontes.-Jim-no-don-tes. From the Greek, *gumnos*, naked, and *odous*, (in the genitive *odontos*,) tooth. Systematic name of a family of fishes.

Gymnotus.—Jim-no-tus. Latin. The generic name of the electric eel.

Gymnoti.—Latin. Plural of Gymnotus.

Haje.—Ha-jee. Specific name of a coluber.

Har′engus.—Generic name of the herring.

He′lena.—Specific name of a kind of eel.

Hepta′tremus. — From the Greek, *epta*, seven, and *trema*, a hole or perforation. Generic name of certain fishes of the order of cyclostomi.

Herbiv′orous. — From the Latin, *herba*, grass, herb, and *voro*, I eat. Grass-eating, herb-eating. Applied to animals which feed on grass or plants.

Herpe'tology. — From the Greek, *erpeton*, a creeping thing, a reptile, and *logos*, a discourse. A treatise on reptiles.

Hexa'gonal.—From the Greek, *ex*, six, and *gônia*, angle. Having six sides or angles.

Hiber'nate.—From the Latin, *hibernare*, to winter, to be in winter quarters. Animals that retire and sleep throughout the winter are said to hibernate.

Hiber'nation.—The act of hibornating. Being in winter quarters.

Hippo'campus. — From the Greek, *ippos*, a horse, and *kampe*, crookedness. Systematic name of the sea-horse.

Hippo'glossus. — From the Greek, *ippos*, a horse, and *glossa*, tongue. Systematic name of the holibut.

Hu'meral cincture. — A chain of bones, forming a sort of belt, which sustains the pectoral fin, (anterior extremity) of fishes.

Hu'merus.—The bone of the arm, which is situate between the shoulder joint and elbow.

Huso.—Specific name of a sturgeon.

Hydrus.—Latin. A water-snake.

Hyla.—From the Greek, *ule*, a wood, trees. Systematic name of the tree-frog.

Hy'oid.—From the Greek, *u*, and *eidos*, resemblance. Resembling the shape or form of the letter U. The *os hyoides*, the hyoid bone, is a very moveable bony arch, placed horizontally in the substance of the soft parts of the neck, at the root of the tongue. It does not articulate with any other bone of the skeleton, and is only connected to it through the medium of muscles and ligaments. The general characters of the hyoid bone, are the same in all vertebrate animals. In fishes, its branches are composed of several pieces, and give support to the *branchiostegous rays*.

Hyoides.—See hyoid.

Ichthyo'logist.—Ik-the-o-lo-jist.—From the Greek, *ichthus*, a fish, and *logos*, a discourse. One skilled in ichthyology.

Ichthyo'logy.—Ik-the-o'l-o-je. From the Greek, *ichthus*, a fish, and *logos*, a discourse. A history of fishes.

Ichthyo'saurus. — Ik-the-o'-saw-rus. From the Greek, *ichthus*, a fish, and *saura*, lizard. Fish-lizard. Systematic name of a kind of fossil.

Ichthyo'colla.—Ik-the-o'-colla. From the Greek, *ichthus*, a fish, and *kolla*, glue. Fish glue. A kind of glue prepared from fishes.

I'guana.—Name of a kind of saurian.

I'guanian.—Applied to saurians of which the type is the Iguana.

I'guanida.—Formed from the aboriginal name, *iguana*, and the Greek *eidos*, resemblance. Systematic name of a family of saurians.

Illy'rica.—Latin. Illyrian; belonging or relating to Illyria.

Imb'ricate.—Laid one over the other like tiles or shingles.

Inci'sor.—From the Latin, *incido*, I cut. The teeth which occupy the anterior part of the upper and lower jaws, are called incisors, or incisor teeth, because they are used for cutting the food in the manner of cutting instruments.

Integument.—From the Latin *tegere*, to cover. The skin. The covering of the body.

Inter-maxillary.—From the Latin, *inter*, between, and *maxilla*, the jaw. Bones situate at the anterior part of the upper jaw between its two sides.

Interspinal.—The *interspinal bones* form a series of strong, dagger-like bones, deeply implanted in the flesh along the middle line of the body of fishes, between the two great masses of lateral muscles: their points generally penetrate to a little distance between the spinous processes of the vertebræ, to which they are connected by a ligamentous attachment; whilst to their opposite extremity, which may be compared to the hilt of the dagger, the corresponding fin-rays are affixed by a beautiful articulation. Each interspinous bone consists of two pieces united by a suture; one portion representing the blade, the other the handle of the dagger, to which we have compared it.

Invertebratæ. — Without vertebræ; wanting the spinal column.

I'ris.—That part of the eye in which the pupil is situate; a vertical partition between the anterior and posterior chambers of the eye.

I'rides.—Plural of iris.

Irritability.—From the Latin *irrito*, I provoke. A power, possessed by all living organized bodies, of being acted upon by certain stimulants, and of moving responsive to or consequently to such stimulation. It is the ultimate vital property.

I'solated.—From the Italian, *isola*, an island; (because one who is isolated, resembles an island entirely surrounded by water.) Separated, alone, single.

Jacula'tor.—Latin. A shooter, a darter, a dart-flinger. Specific name of a shooting-fish.

La'bial.—From the Latin, *labium*, lip. Belonging or relating to lips.

Labrax.—Greek. Specific name of a kind of Perch.

Labyrinthi'form.—From the Greek, *laburinthos*, a labyrinth, and the Latin, *forma*, form, shape. Systematic name of a family of fishes.

Lace'rta.—Latin. A lizard.

Lace'rtian.—Applied to animals resembling lizards.

Lacertinida. — From the Latin, *locerta*, a lizard, and the Greek, *eidos*, resemblance. Systematic name of a family of saurians.

Lach'rymal.—lak'-re-mal. From the Latin, *lachryma*, a tear. Belonging or relating to tears.

Lamella.—Latin. A little thin plate, or piece.

Lamellæ.—Latin. Plural of lamella.

Lanceolatus.—Latin. Lance-shaped.

Larva.—Latin. A mask. An insect after it has left the egg, and before it assumes the form of a chrysalis, is called a larva, because in this state it is, as it were, masked.

Larvæ.—Latin. Plural of larva.

Larynx.—From the Greek, *larugx*, a whistle. The apparatus of voice.

Leuci'scus.—Latin. Generic name of the roach.

Liberis.—Latin. (Ablative plural.) Free.

Ligament.—From the Latin, *ligare*, to tie. A name given to fibrous structures which serve to unite bones, and form articulations.

Limanda.—From the Latin, *lima*, a file. Specific name of a fish.

Lophobranchi'an.—lo-fo-brank'-e-an. From the Greek, *lophos*, a tuft, or top-knot, and *bragchia*, gills. Applied to fishes of the order of Lophobranchii.

Lophobranch'ii. — lo-pho-brank'-e-i. Latin. Plural of Lophobranchus. Same derivation as the last. Systematic name of an order of fishes.

Loricatæ.—Latin, (plural.) Loricate. Armed with a coat of mail; clad in armour.

Lota.—Systematic name of the Ling.

Lozenge-shape.—Shaped like a lozenge, which is a figure with four equal sides, forming two acute and two obtuse angles, thus; ◇

Lu'bricate.—To make smooth or slippery.

Lu'cius.—Latin. A pike.

Malacoptery'gian.—From the Greek, *malachos*, soft, and *pterux*, fin. Soft-fin. Applied to fishes that have no bony fin-rays.

Malacopterygii.—Latin. Plural of malacopterygius. Same derivation as the last. Systematic name of an order of fishes.

Malapte'ruri. — Latin. Plural of malapterurus. Formed from *mala*, much, *pteron*, fin, and *reô*, I fall off. Imperfect fins. Generic name of a fish of the family of siluroides.

Ma'mma.—Latin. The breast, pap, or teat.

Ma'mmæ.—Latin. Plural of mamma.

Ma'mmal.—Any animal having teats for suckling its young, is called a mammal.

Mamma'lia.—From the Latin *mamma*, breast. Systematic name of the class of animals that suckle their young.

Mari'nus.—Latin. Marine; belonging or relating to the sea.

Mas'ticatory. — From the Greek, *mastichaô*, I chew. Relating to mastication, or the act of chewing the food.

Masto'id.—From the Greek, *mastos*, a nipple, and *eidos*, resemblance. A process or projection of the temporal bone, (behind the ear,) is so called, on account of its shape.

Max'illary.—From the Latin, *maxilla*, a jaw. Belonging or relating to the jaws.

Max'imus.—Latin. Greatest, largest.

Membrane.—A name given to different thin organs, representing species of supple, more or less elastic, webs.

Mem'branous.—Belonging to, or partaking of the nature of a membrane.

Menides.—From the Latin, *mæna*, or *mena*, a kind of fish. Systematic name of a family of fishes.

Menobranch'us. — me-no-brank'-us. From the Greek, *menos*, strength, and *bragchia*, gills. Systematic name of a genus of batrachians.

Menopoma.—Generic name of a kind of batrachian.

Merlangus.—Latin. Formed from the French, *merlan*, a whiting. Systematic name of the whiting.

Merluc'cius.—Specific name of the hake.

Metamor'phosis.—From the Greek, *meta*, after, and *morphe*, form. Transformation. Applied to the organic changes which take place in certain animals.

Mol'lusca.—From the Latin, *mollis*, soft. Systematic name of a class of animals without vertebræ.

Mollusk.—Any animal of the class of mollusca.

Monitor'.—Latin. Generic name of a kind of saurian.

Morrhua.—Systematic name of the cod-fish.

Mosasaurus.—Systematic name of a fossil saurian.

Motive.—From the Latin, *moveo*, I move. That which moves or causes motion.

Mucos'ity.—A fluid which resembles mucus, or contains a certain quantity of it.

Mu'cous—Belonging or relating to mucus.

Mu'cus.—Animal mucilage. A peculiar fluid secreted by mucous membranes.

Mugil.—Latin. A mullet.

Mugiloi'des.—From the Latin *mugil*, a mullet, and *eidos*, resemblance. Systematic name of a family of fishes.

Mulloi'des.—From the Latin, *mullus*, a barbel, a red-mullet, and *eidos*, resemblance. Systematic name of a family of fishes.

Mullus.—Latin. A barbel, a red-mullet.

Muræna.—Latin. From the Greek, *muraina*, a kind of fish resembling an eel. Systematic name of eels.

Muræ'næ.—Latin. Plural of muræna.

Myxine.—From the Greek, *muxinos*, which is formed from *muzô*, I suck. Systematic name of the hag-fish.

Nacre'ous.—From the Spanish *nacar*, mother of pearl. Of the nature of mother of pearl.

Naja.—Specific name of a serpent.

Nasal.—Belonging or relating to the nose. Nasal fossæ, (See Fossæ.)

Naucra'tes.—From the Greek, *naus*, a vessel, and *krateô*, I have power over. Systematic name of certain fishes.

Nilotica.—Latin. Belonging or relating to the Nile.

Nuda.—Latin. Naked.

Ocellate.—From the Latin, *oculus*, an eye. Having marks resembling an eye.

Œsophagus.—Es-o'-fa-gus. From the Greek, *oisô*, I carry, and *phagein*, to eat. The gullet. The membranous canal which conveys food from the mouth to the stomach.

Olfac'tory.—From the Latin, *olfactus*, the smell. Belonging or relating to smell.

Omniscient.—From the Latin, *omnis*, all, every thing, and *scio*, I know. All-knowing.

Oper'cula.—Latin. Plural of operculum.

Oper'cular.—Belonging or relating to operculum.

Oper'culum. — Latin. A cover, a lid. A bony plate, which, in a great many fishes, covers the gills. The gill-cover. The little cover, or kind of door, which closes the entrance, or mouth of a shell.

Ophi'dia.—From the Greek, *ophis*, serpent. Systematic name of an order of reptiles.

Ophi'dian.—Any reptile of the order of ophidia.

Orbit. — From the Latin, *orbis*, a circle. The circular cavities which lodge the organs of vision, are called orbits.

Or'bital.—Belonging or relating to the orbits.

Organ.—From the Greek, *organon*, an instrument. Part of an organised being, destined to exercise some particular function; for example, the ears are the organs of hearing, the muscles are the organs of motion, &c.

Orga'nic.—Relating to an organ.

Orga'nised.—Composed of organs; having a mode of structure.

Organization.—The mode, or manner of structure of an organised being.

Os.—Latin. Bone.

Osme'rus. — Generic name of the smelt.

Os'seous.—From the Latin, *os*, bone. Bony, composed of bone.

Os'sified—Applied to that which has become bone.

Os'sification.—From the Latin, *os*, bone, and *facere*, to make. The formation of bone. The process by which bone is formed.

Ostracion.—From the Greek, *ostrakon*, a shell, a scale. Generic name of the trunk-fish.

Ovi'parous.—From the Latin, *ovum*, an egg, and *parere*, to bring forth. Animals that multiply by means of eggs, are oviparous.

Ovo-vivi'parous. — From the Latin, *ovum*, egg, *vivus*, alive, and *parere*, to bring forth. Animals that multiply by means of eggs, which are hatched before they are laid.

Ox'ygen.—ox'-e-jin. From the Greek *oxus*, acid, sour, and *gennaô*, I engender. The *generator of acid*, as it was believed to be exclusively when this name was given to it. A gas which constitutes about one fifth of our atmosphere, which is necessary to the respiration of animals, and consequently, indispensable to animal life. But it cannot be breathed alone for any considerable time with impunity, requiring to be mixed with about four parts of nitrogen, (azote) as is the case in our atmosphere to render it suitable for respiration.

Palatine.—Relating to the palate.

Pal'mate.—From the Latin, *palma*, the palm. Having the form of the palm, from the toes or fingers being united by a membrane.

Pan'creas.—From the Greek, *pas*, all, and *kreas*, flesh. All fleshy. A gland deeply seated in the abdomen, which resembles the salivary gland in its structure, and has been called the *abdominal salivary gland*.

Papi'lla.—Latin. A nipple. A name given to small eminences, which appear to be formed by the ultimate expansion of the vessels and nerves.

Papillæ.—Latin. Plural of papilla.

Parachute.—From the Greek, *para*, against, and the French *chute*, a fall. A machine somewhat in the form of the top of an umbrella, used to moderate the descent of those who ascend in balloons, and guarantee them against the effects of a sudden fall.

Pari'etes.—From the Latin, *paries*, a wall. A name given to parts which form the inclosure — the limits of different cavities of the body.

Parotid.—From the Greek, *para*, about, and *ous*, the ear. A large salivary gland situated near the ear is so called.

Pecten.—Latin. A comb. A fold or process of the retina, found in some animals, is so called.

Pectiniform. — From the Latin, *pecten*, a comb, and *forma*, form, shape. Comb-shaped; like a comb.

Pectinate.—Formed like a comb; having teeth like a comb.

Pec'toral.—From the Latin, *pectus*, (in the genitive, *pectoris*,) the chest, the breast. Belonging or relating to the chest.

Ped'icle.
Ped'uncle. From the Latin, *pes*, (in the genitive, *pedis*,) foot. A little foot; a stem.

Pela'mys. — Specific name of the Bonita.

Pelvis.—The bony structure at the lower part of the trunk.

Perca.—Latin. A Perch.

Percoides.—From the Latin, *perca*, perch, and *eidos*, resemblance. Systematic name of a family of fishes.

Peritoneum.—From the Greek, *peri*, around, and *teinô*, I stretch. A serous membrane which lines the abdominal cavity, and covers, entirely, or in part, all the organs contained in it.

Petromyzon.—From the Greek *petra*, rock, and *muzô*, I suck. Rock-sucker. Systematic name of the lampreys.

Pharynge'al.—Belonging or relating to the pharynx.

Pharynge'an. — Applied to certain fishes.

Pharynx.—From the Greek *pharugx*, the pharynx. The swallow. The superior opening of the œsophagus

Physio'logy.–From the Greek, *phusis*, nature, and *logos*, a discourse. The science which treats of the functions of animals or vegetables.

Pitu'itary.—From the Latin, *pituita*, phlegm. The lining membrane of the nose is called the pituitary membrane.

Pisciformis.—Latin. Fish-shaped; formed like a fish.

Plas'trum.—The inferior shell of a tortoise.

Plates'sa.—From the Greek, *platus*, broad, flat. Systematic name of the plaice.

Platurus.— Generic name of certain ophidians.

Plecto'gnathi. — From the Greek, *plektos*, twined, joined together, and *gnathos*, jaw, cheek. Systematic name of an order of fishes.

Plesiosaurus. — From the Greek, *pleisos*, most, and *saura*, a lizard. The systematic name of a fossil saurian.

Pleuronectes. — From the Greek, *pleura*, the side, and *nectes*, fin. Systematic name of a family of fishes.

Pneumogastric. — From the Greek, *pneumôn*, the lung, and *gaster*, the stomach. The name of a nerve which is distributed chiefly to the organs contained in the chest and abdomen.

Polyo'don.—From the Greek, *polus*, many, and *odous*, (in the genitive, *odontos*,) tooth. Name of a kind of sturgeon.

Porta.—Latin. A gate.

Polygo'nal.—From the Greek, *polus*, many, and *gôna*, angle. Having many sides and many angles.

Pre'hension.—From the Latin, *prehendere*, to lay hold of. The prehension of aliments consists in laying hold of, and conveying food to the mouth.

Pre-operculum.—A part of the gill-cover.

Pristis.—Latin. Generic name of the saw-fish.

Process.—From the Latin, *procedo*, I go before. An eminence of bone; a bony projection.

Pro'teus.—From the Greek, *prôtos*, first. Name of a particular reptile.

Protra'ctile.—Susceptible of being extended or stretched out.

Pteroda'ctylus.—From the Greek, *pteron*, wing, and *daktulos*, finger. Name of a fossil.

Pter'ygoid.—ter'-e-goid. From the Greek, *pterux*, wing, and *eidos*, resemblance. Name of a bone which is connected to the palate bones.

Pu'lmonary.—Belonging or relating to the lungs.

Pupil. — The aperture of the iris, through which the rays of light pass, that have to paint the image of an object on the retina.

Pygmæus. — Latin. Small, little, dwarfish, pigmy.

Pylo'rus.—From the Greek, *pule*, gate, and *ouros*, a guardian. The right orifice of the stomach.

Python—From the Greek, *puthon*, a serpent. Generic name of certain ophidians.

Quadrangular. — From the Latin, *quatuor*, four, and *angulus*, angle. Having four angles or sides.

Radius.—Latin. A spoke. One of the bones of the fore-arm, so called from its shape.

Raia.—ry-a. Latin. A ray-fish.

Rana.—Latin. A frog.

Reg'imen.—From the Latin, *regere*, to govern. The rational and methodical use of food, and every thing essential to life; both in a state of health and disease. It is often restricted in its meaning to *diet*.

Remo'ra.—Latin. A hindrance. The name of a fish.

Repti'le.—From the Latin, *repere*, to crawl. An animal that crawls, that drags itself along on its belly like serpents and worms. Also applied to animals that have legs so short that they seem to crawl.

Resp'iration.—From the Latin, *respiro*, I take breath. A function proper to animals, the object of which is to place the materials of the blood in contact with atmospheric air, in order that it may acquire the vivifying qualities that belong to arterial blood. Aquatic animals find sufficient air for their respiration, mixed with, or dissolved in the water.

Ret'ina.—From the Latin, *rete*, a net. The essential organ of vision. situated within the eye-ball: on it the images of objects are impressed.

Retra'ctile.—Susceptible of being drawn back.

Rhomboidal.—Lozenge-shaped.

Sacrum.—Latin. Sacred. The bone which forms the posterior part of the pelvis, and is a continuation of the vertebral column.

Salar.—Specific name of the salmon.

Sali'va.—Spittle.

Sali'vary.—Belonging or relating to saliva.

Salmo.—Latin. A salmon.

Salmoni'des.—Systematic name of a family of fishes.

Sardina.—Latin. A sardine.

Sargus.—Latin. Name of a fish.

Sau'ria.—From the Greek, *saura*, a lizard. Systematic name of an order of reptiles.

Saurian.—Any reptile of the order of sauria.

Sauvegarde.—French. Name of a saurian.

Sca'pula.—The shoulder-blade.

Schist.—From the Greek, *schizein*, to divide. A sort of stone which separates into leaves or plates like slate, but not to the same extent. A generic name given by geologists to all minerals which split or divide into very thin plates.

Scienoides.—Systematic name of a family of fishes.

Scincoidea.
Scincoides. — From the Greek, *skigkos*, a sort of crocodile, and *eidos*, resemblance. Systematic name of a family of saurians.

Scinque.—French. A kind of saurian.

Sclerodermi.—skler-ro-dur-mi. Latin. Plural of sclerodermus. From the Greek, *skleros*, hard, and *derma*, skin. Hard-skinned. Systematic name of a family of fishes.

Sclerops. — skle-rops. From the Greek, *skleros*, hard, and *ops*, eye. Specific name of a kind of crocodile.

Scomber.—Latin. A mackerel.

Scomberoi'des. — From the Greek, *skombros*, mackerel, and *eidos*, resemblance. Systematic name of a family of fishes.

Scyllium.—From the Greek, *skullô*, I tear in pieces. Systematic name of the shark.

Secre'tion,—From the Latin, *secernere*, to separate. The organic functions of the several glands, by which they separate from the blood the materials which they respectively demand for their several purposes: each organ according to its peculiar structure, differs from the rest, and hence we have the formation of the different fluids, as bile, saliva, milk, &c. &c. The fluids thus elaborated, or separated from the blood are also termed secretions.

Selachii. — se-lak-e-i. Plural of selachus. In the Greek, *selachos*. An order of cartilaginous fishes.

Serpentia.—Systematic name of a family of ophidians.

Serpentina.—Latin. Belonging or relating to a serpent.

Serrated.—From the Latin, *serra*, a saw. Notched or toothed like a saw.

Siluroides.—From the Greek, *silouros*, name of a particular fish, and *eidos*, resemblance. Systematic name of a family of fishes.

Siluri.—Latin. Plural of silurus.

Silurus.—Latin. Name of a fish.

Sinus. — Any cavity, the interior of which is more expanded than the entrance; in this respect, being the reverse of *fossa*. *Venous sinus* is a venous canal into which a number of vessels empty.

Siren, or Syren.—From the Greek, *seira*, a chain, from the supposed strength of its charms. A fabulous monster. Name of a kind of batrachian.

Solea.—Latin. A sole.

Sparoides.—From the Latin, *sparus*, a kind of fish, and the Greek, *eidos*, resemblance. Systematic name of a family of fishes.

Sparus.—Latin. Name of a kind of fish; a dart.

Spatularia.—Systematic name of a kind of sturgeon.

Specific.—Any medicinal substance, to which is attributed the property of curing one disease rather than any other. It is doubtful whether any such remedy really exists.

Specific gravity.—Is the weight of any body, solid or fluid, comparatively with the weight of an equal volume of distilled water; or, specific gravity is the gravity or weight of two bodies, solid or fluid, which possess different weights when of equal volume.

Sphenoid.—From the Greek, *sphen*, a wedge, and *eidos*, resemblance. A bone, situate on the middle line, and at the base of the cranium. It articulates with all the other bones of the cranium, and strengthens their union, acting very much like the key-stone of an arch.

Spinous.—Belonging or relating to a spine.

Spiracle.—From the Latin, *spirare*, to breathe. A breathing hole or nostril in aquatic animals.

Spleen.—One of the organs of the abdomen, the precise use of which is not known.

Squalides.—Systematic name of a family of fishes.

Squali.—Latin. Plural of squalus.

Squalus.—Latin. A shark.

Squamipennes. — From the Latin, *squama*, a scale, and *penna*, a feather. Systematic name of a family of fishes.

Stellio.—Latin. A kind of saurian.

Sternal.—Belonging or relating to the sternum.

Sternum.—The breast-bone.

Sturio.—Specific name of the common sturgeon.

Sturiones,—Systematic name of an order of fishes.

Stylet.—Diminutive of style. A slender process or needle-like projection of bone.

Subbrachiati.—sub-brak-e-a-ti. Latin. Plural of subbrachiatus. From the Latin, *sub*, beneath, and *brachium*, arm. Applied to an order of fishes that have the ventral beneath the pectoral fins, that is, the arms.

Subbrachian. — sub-brak-e-an. Applied to fishes of the order of subbrachiati.

Subcaudal.—From the Latin, *sub*, under, and *cauda*, tail. Applied to that which is beneath the tail.

Surmulus.—Latin. A surmullet.

Suture.—From the Latin, *suo*, I stitch. A kind of immoveable articulation or joint, in which the bones unite by means of serrated edges, which are, as it were, *dovetailed* into each other. The articulations of the bones of the cranium are of this kind.

Tactile sensibility.—The sensibility which enables us to perceive impressions through the means of the sense of touch.

Tænioides.—From the Latin, *tænia*, a ribbon, and the Greek, *eidos*, resemblance. Systematic name of a family of fishes.

Tadpole.—From the Saxon, *tad*, toad, and *pola*, a young one. The young of the batrachians are called tadpoles.

Ten'dinous.—Belonging or relating to tendon

Ten'don.—From the Greek, *teinô*, I stretch. Strong, white, fibrous cords, which connect the muscles to the bones which they move. The tendons may be considered as so many cords, for transmitting the motion of the muscles to the bones. They are sometimes vulgarly designated under the name of "leaders."

Testudo.—Latin. A tortoise.

Tetrodon.—From the Greek, *tetra*, four, and *odous*, (in the genitive, *odontos*,) tooth. Systematic name of certain fishes.

Thermo'meter. — From the Greek, *thermos*, heat, and *metron*, measure. An instrument for measuring the different degrees of heat or cold, by means of the expansion and contraction of the fluid, (commonly mercury,) contained in it.

Theutyes.—Systematic name of a family of fishes.

Thoracic.— Belonging or relating to the chest.

Thorax.—From the Greek, *thorax*, the chest. The cavity destined to lodge the chief organs of respiration and circulation, the heart and lungs. The chest.

Thymallus.—Systematic name of the graylings.

Thynnus—Systematic name of the tunny.

Tibia.—Latin. A flute. The largest bone of the leg is so called.

Tinca.—Latin. A tench.

Tissue.—From the Latin, *texere*, to weave. The interlacement or union of many things which form a body, as threads of flax, silk, wool, &c., of which cloths and stuffs are made. From analogy, the term is employed in anatomy, to describe the *substances* of which the organs of animals in general, and of man in particular, are formed, and which result from the interlacement of fibres. It is applied to different kinds of organization of the body, as, for example, the *muscular* tissue, *osseous* tissue, meaning the structure of which the muscles and bones are composed.

Torpedo.—Latin. Numbness. Name of a fish

Tortrix.—Generic name of certain ophidians.

Toxotes.—From the Greek, *toxotes*, an archer. Systematic name of certain fishes.

Trach'ea.—trak-e-a. From the Greek *trachus*, rough, and *arteria*, an artery, which is formed from *aer*, air, and *terein*, to keep. The canal which conveys air to the lungs. The wind-pipe.

Trenchant.—Cutting.

Trigonocephali. — tri·gon-o-kef-a-li. Latin. Plural of trigonocephalus.

Tri'gonocephalus.—From the Greek, *treis*, three, *gonia*, angle, and *kephale*, head. Triangular head. The systematic name of a serpent.

Tri'lobed.—From the Latin, *tres*, three, and *lobus*, lobe. Formed of three lobes.

Tri'onyx.—From the Greek, *treis*, three, and *onux*, nail. Having three nails. Generic name of certain tortoises.

Truncate.—Cut abruptly or square off; cut short

Trunk.—The body without including the head and extremities.

Trutta.—Specific name of the trout.

Tubercle.—From the Latin, *tuber*, a knot. A small knot, or projection.

Tuberculous.—Composed of, or containing tubercles.

Tympanum.—Latin. A drum. The drum of the ear.

Typhlops. — tif-lops. Greek. One who is blind. Name of an ophidian.

Ulna.—The bone of the fore-arm, which forms the prominence of the elbow, during the flexion of that joint.

Umbrina.—Generic name of a fish.

Urodela. — Systematic name of a family of batrachians.

Vascular.—Supplied with vessels.

Vena.—Latin. A vein. *Vena porta*, a vein of the liver.

Venous.—Relating to veins.

Ventral.—From the Latin, *venter*, belly. Belonging to the belly.

Ventricle.—A name given to various parts by anatomists.

Ventricular.—Belonging to a ventricle; of the nature of a ventricle.

Vermiform.—From the Latin, *vermis*, a worm, and *forma*, form. Worm-shaped: like a worm.

Vernalis.—Latin. Vernal. Relating to the spring.

Vertebra.—From the Latin, *vertere*, to turn. This name has been given to each of the bones, which, by their union, form the vertebral or spinal column, commonly called the back bone.

Vertebræ.—The plural of vertebra.

Vertebral.—Belonging or relating to vertebræ.

Vertebrata.—Animals that possess vertebræ. Systematic name of the first branch of the animal kingdom.

Vertebrate.—Having vertebræ.

Verticillate.—From the Latin, *verticillum*, a peg. Arranged in a circle, like the leaves of certain flowers around a stem.

Vestibule.—The first part of the second cavity of the ear is so called.

Vipera.—Latin. A viper.

Viridis.—Latin. Green.

Viscera—Latin. Plural of viscus.

Viscid. } Glutinous, sticky, tenacious
Viscous. }

Viscus.—Latin. Any bowel, or entrail, or internal part, as the heart, liver, lungs, brain, &c.

Vivi'parous.—From the Latin, *vivus*, alive, and *pario*, I bring forth. Animals whose young are born without being hatched, are said to be viviparous.

Vomer.—Latin. A thin, flat bone, which constitutes a part of the partition between the nostrils.

Vulga'ris—Latin. Common, vulgar.

Xiphias.—Latin. A sword-fish.

Zoology. — zoo-lo-gy. From the Greek, *xôon*, life, and *logos*, a discourse. That part of Natural History which treats of animals.

Zoologist.—One skilled in, or devoted to the study of zoology.

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